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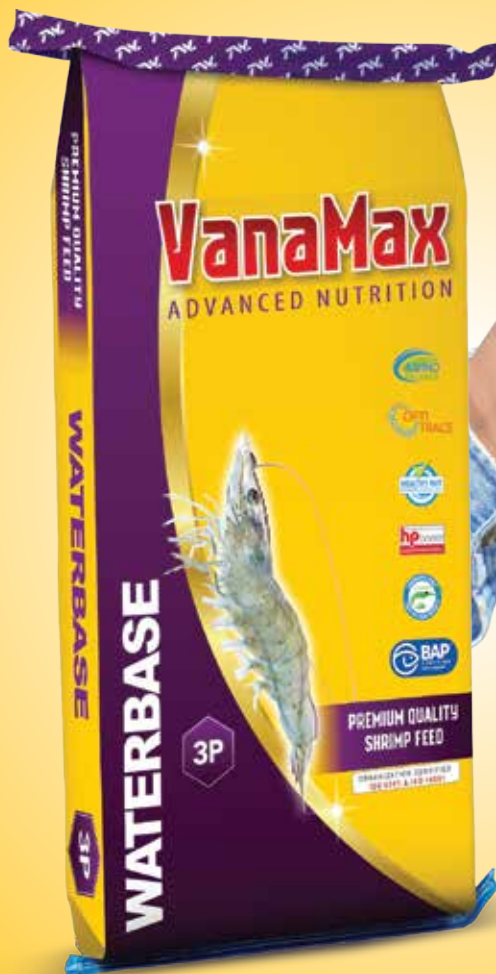
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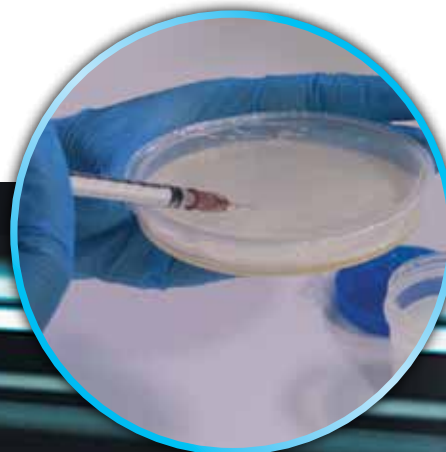
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NRS Publications,
BG-4, Venkataramana Apartments,
11-4-634, A.C.Guards,
Hyderabad - 500 004, India.
Tel: 040 - 2330 3989, 96666 89554
E-mail: info@aquainternational.in
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- Editor



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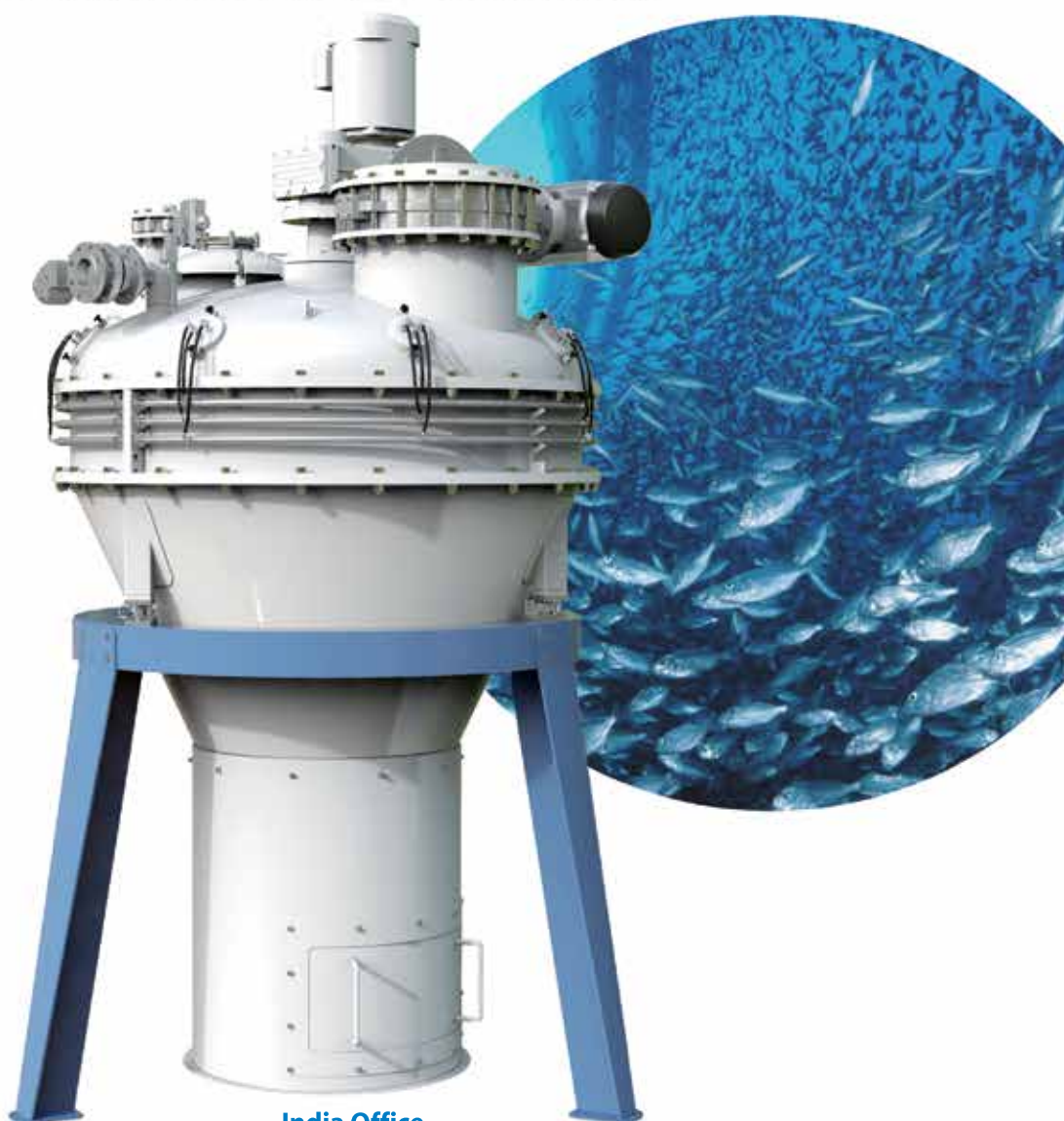
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T: +62-21-30027458; 30027459
Contact: Arun Kumar K
E-mail : arunkumar@famsungroup.com
Mob: +91 9901916554

Contact: Shelby
E-mail: lxb@famsungroup.com
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India's shrimp farming crisis demands structural reform

Rainy season is one of the most challenging periods in shrimp farming. Production losses are often attributed to rainfall itself; however, rain is only the initiating event. The real challenge lies in the rapid environmental changes that follow, including reductions in temperature and salinity, fluctuations in dissolved oxygen (DO) and pH, changes in phytoplankton and microbial communities, and increased physiological demands on shrimp. Successful shrimp farming during the rainy season depends on anticipating environmental changes and adapting pond management early.



Dear Readers,

The September 2026 issue of Aqua International is in your hands. In the news section, you may find news about....

India's shrimp farming crisis demands structural reform.

Indian shrimp farmers are facing rising feed costs and falling farm gate prices, so will need more than short-term relief to survive. Logistics costs could also be reduced by transporting Soybean from growing hubs like Madhya Pradesh to coastal feed mills by creating subsidised aqua feed express rail corridors. The APSFPMC constituted by the Government of Andhra Pradesh needs to link feed costs to domestic raw material prices, and international shrimp export values in order to enable farmers and manufacturers share market risks and rewards more equitably. The times supports this argument as this will ensure a dynamic, transparent pricing index that has moved away from reactive price caps. In the medium term, the government must incentivise the feed industry to adopt black soldier fly (BSF) larvae as a direct, locally produced alternative for fishmeal. Efforts must also be scaled up by the feed industry to use single cell proteins by partnering with biotechnology companies to produce bacterial or algal proteins utilising agricultural waste, reducing dependence on imports from Chile and Peru. The productivity of non-GM Soybeans in India is low. High yielding, pest resistant non-GM varieties should be introduced as soon as possible to boost domestic production and address the current supply deficits.

Khyber Aquaculture Partners with J&K Government to Modernise Trout Farming. Progressive farmers trained in sustainable

aquaculture and fish health management. Khyber Aquaculture, in partnership with the Jammu & Kashmir Department of Fisheries, has launched a specialised training programme to equip local trout farmers with modern, sustainable aquaculture practices. The initiative, part of the Project No 22 Implementation of Trout Cluster Programme covering Ganderbal and Anantnag, under Holistic Agriculture Development Plan (HADP) designed to transform traditional trout farming into a more scientific, efficient, and resilient industry. The training brought together progressive farmers from Ganderbal, Bandipora, and Srinagar for an intensive session on "Sustainable Trout Aquaculture and Fish Health Management".

Plunging catches and policy delays hit fisheries sector. Fishermen forums are calling for urgent government intervention and a concrete financial relief package, warning that without immediate action, the coastal economy could face a complete collapse. It is almost a month into the post-trawl ban season, a period usually marked by bustling docks and overflowing catches. But a grim shadow of uncertainty hangs over Keralam's coastline as empty nets and grounded boats tell a story of quiet desperation. Barren waters, unrelenting weather bans, and tragic accidents have brought the fishing community to its knees while the promise of government relief remains out of reach. Both traditional fishers and boat operators say they are caught in a deep economic crisis, facing prolonged periods of unemployment with little clarity on relief or compensation from the government.

Fishers' Organisations in India Demand Recognition from FAO. India is ranked the second-largest fish-producing nation globally, accounting for around 8 percent of global output. The fisheries sector in India accounts for nearly 7.43 percent of Agricultural Gross Value Added (GVA), the highest (independent) share among



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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.

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the agriculture and allied sectors. According to government statistics, India's fish output doubled from 95.79 lakh tonnes in FY 2013-2014 to 197.75 lakh tonnes in FY 2024-2025, a 106 per cent increase. The Union Budget of 2026-2027 proposed ₹2,761.80 crore for the fisheries sector, marking the highest-ever annual budgetary allocation for this sector. India's "Blue Revolution", which commenced in 2015 and is backed by central schemes like the Pradhan Mantri Matsya Sampada Yojana, launched in 2020, aims to strengthen the fisheries sector through infrastructure expansion and modern practices. Yet, in India, the fisheries department at the central level is a part of the Ministry of Fisheries, Animal Husbandry & Dairying. This needs a revamp, with fisheries being declared an independent sector nationally and regionally.

The completion of the JAPFA STP Make in India Aqua Feed Partner Conferences 2026, held on 29 July 2026 at Lucknow and 30 July 2026 at Vijayawada, marked a significant milestone in their continued commitment to advancing India's aquaculture industry. As India's aquaculture sector continues to evolve and emerge as a critical contributor to food security, rural livelihoods, and economic growth, the need for innovation-led partnerships has never been greater. Recognizing this opportunity, JAPFA STP hosted conferences to facilitate dialogue among industry leaders, entrepreneurs, distributors, farmers, and aquaculture experts, creating an environment where knowledge and experience could be shared to address both current challenges and future opportunities.

OME Enterprises deals with 20 feed, over 100 Healthcare Cos, Its a record in Indian aquaculture sector. Mr Ravi Pericherla, Founder & Managing Partner of OME Enterprises, says that decision to maintain an extensive portfolio featuring over 20 top-tier feed manufacturers and more than 100 registered health, nutrition, and probiotic companies is a deliberate, strategic, and farmer-first choice. Ravi sated that true success in aquaculture is measured not merely by crop volume, but by the lasting trust built with every farmer on the ground.

Mr Jarl van den Berg, Managing Director, Hendrix Genetics, Kona Bay during his visit in India from 24 to 29 August 2026 talking to Aqua International Editor said that all our success is attributed by the investment in our R&D programs, and the dedication of our team to support the hatchery operators and shrimp farmers. We have a mission to provide India with the best shrimp genetics. We have as a vision to set the standard of the most sustainable shrimp breeding in India – and our values are dedicated to the team, the shrimp and the farmers. In the Articles section, **Rainy Season Readiness: An Adaptive Approach to Shrimp Pond Management** authored by Dr Natthinee Munkongwongsiri and Dr Pajaree Jueliang discussed that the rainy season is one of the most challenging periods in shrimp farming. Production losses are often attributed to rainfall itself; however, rain is only the initiating event. The real challenge lies in the rapid environmental changes that follow, including reductions in temperature and salinity, fluctuations in dissolved oxygen (DO) and pH, changes in phytoplankton and microbial communities, and increased physiological demands on shrimp. These changes can challenge shrimp resilience and may create conditions that favor opportunistic problems. Successful shrimp farming during the rainy season depends on anticipating environmental changes and adapting

pond management early. This article explains the biological mechanisms behind rainy-season production challenges and provides a practical framework for adjusting management according to how the pond and shrimp respond.

Another article titled, **Eco-Friendly Aquaculture: Harnessing Agro-industrial Wastes for Feed and Water Quality Management** authored by Hema Dhruw, Dushyant Kumar Damle, Jham Lal, Rupesh Kumar, Rakesh Nirmalkar, Sai Prashad Bhusare and Manorama Chauhan discussed that aquaculture has become an essential contributor to global food security, yet its rapid rise has highlighted problems linked to feed shortages, high production costs, environmental damage, and excessive dependence on chemicals and fishmeal. Agro-industrial wastes generated by crop milling, fruit and vegetable processing, sugar businesses, breweries, and oilseed extraction units offer a sustainable and cost-effective alternative for feed formulation and water quality management. Useful applications show substantial economic benefits, such as rice bran in aquaculture, fruit peel extracts, and brewery leftover grain.

Another article titled, **Artificial Intelligence for Aquamimicry for India: Towards Zero-Waste Aquaculture Systems for Shrimp and Fin fishes** authored by A.M. Raksha, G.K. Raswin Geoffery and S. Felix says that aquamimicry is a sustainable shrimp farming technique that mimics natural aquatic ecosystems without harmful chemicals. It uses probiotics, rice bran, and beneficial microbes to promote natural food organisms like copepods. This approach improves shrimp health, feed efficiency, disease resistance, and water quality. Aquamimicry reduces environmental impacts while supporting eco-friendly and profitable aquaculture. It offers a promising solution for sustainable large-scale and semi-intensive shrimp farming.

Another article titled, **Scatophagus argus – less regarded as brackishwater foodfish and more as aquarium fish** authored by Subrato Ghosh says that the brackishwater fish *Scatophagus argus* prefers habitats like estuaries and mangrove forest water bodies in West Bengal. It can be maintained both in freshwater and marine aquarium, behaves calmly. It has unique appearance, with presence of many leopard-like round blackish-brown dots / spots on body surface on mainly upper half on both sides laterally. Juvenile / fingerling stage *S. argus* is an economically-important ornamental fish, much desired by hobbyists and in demand. It accepts both plant and animal food matter (boiled lettuce, soaked oatmeal porridge, aquarium plant *Nitella* sp, algae, water flea *Daphnia* sp, small worms) when kept in aquarium. A demerit of this fish is that it inflicts severe pain when any one of its strong spinous rays of dorsal fin or anal fin pierce into palm of an inexperienced careless fish catcher or farm worker.

Farmers are advised not to neglect and do not compromise in good farming and management practices to get specified results. As shrimp and fish are food for human consumption, maintain quality in all aspects to get better acceptance and price to your produce. Readers are invited to send their views and comments on the news, special feature and articles published in the magazine Aqua International which would be published under "Readers Column".

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India's shrimp farming crisis demands structural reform

Indian shrimp farmers are facing rising feed costs and falling farm gate prices, so will need more than short-term relief to survive.



Across India, rising feed costs are putting pressure on shrimp farmers, affecting both giant tiger prawn and whiteleg shrimp producers

In India, more than 90 percent of shrimp farmers operate on less than two hectares. Their margins have been squeezed by escalating input costs and plunging farm gate prices. Feed accounts for as much as 50-60 percent of total production costs, leaving small farmers particularly exposed to price fluctuations.

Pressure on shrimp feed costs

From the perspective of the shrimp feed manufacturers, raw materials account for as much as 75 percent of total production costs. The major protein sources in shrimp feed are fish meal, which is highly dependent on imports, and soybean meal, which has historically been produced domestically but is also now under supply pressure. Since imports of genetically modified (GM) soybeans are prohibited in India, feed manufacturers procure domestically produced non-GM soybean meal (SBM), which can cost twice as much as it does on international markets.

Marine fish meal production depends on highly variable catch volumes and is also subject to increasing environmental regulations on pelagic fishing. These factors drive up unit costs. According to a 2024 report by Mordor Intelligence, nearly 60-65 percent of premium, high-quality fish meal used by Indian shrimp feed producers is imported from Chile and Peru. To support shrimp farmers and make the industry more competitive, the Indian government reduced the import duty on fish meal from 15 percent to 5 percent in the Union Budget 2023-24.

Soybean meal is another large contributor, with close to 35 percent of India's total aquaculture feed volume being dominated by the plant protein. Indian soybean production has declined by around 17 percent, to between 11 million and 12.7 million tonnes. This has created an acute domestic shortage and driven a 40 percent spike in soybean

meal prices. The deficit has prompted industry bodies, including the Compound Livestock Feed Manufacturer's Association of India (CLFMA), to seek emergency imports of 1.5 million tonnes of GM soybean meal.

Compounding these pressures, higher fuel and domestic transport costs have increased the expense of moving raw materials to manufacturing hubs and finished feed to farms.

Farmers' protests and immediate policy relief

Rising costs have fuelled widespread farmer frustration. Feed prices rose by ₹12,000 to ₹14,000 (\$145-\$170) a tonne between February and June 2026, according to reports in The Times of India and Aquafeed.com. The Times also reports that the Andhra Pradesh Prawn Federation, the Vasishta Godavari Aqua Farmers Association and other regional bodies have alleged cartelisation among feed manufacturers and corporate processing plants. They claim that

companies maintain high feed margins while simultaneously depressing farm gate prices, exploiting the highly perishable nature of harvested shrimp and forcing farmers to accept suboptimal returns. These concerns have prompted calls for a harvest boycott and a localised "aqua crop holiday".

At a high-level meeting chaired by the chief minister of Andhra Pradesh, Mr Chandrababu Naidu, the maximum retail price of aquafeed was reduced by ₹4/kg (\$0.05/kg), bringing prices down to roughly ₹108/kg (\$1.30/kg). In order to track raw materials costs and establish transparent feed margins, the Government of Andhra Pradesh has set up a 15 member Andhra Pradesh Shrimp Feed Ingredients Price Monitoring Committee (APSFIPMC) under G.O.Rt No. 180 in June 2026. This committee with three designated farmer representatives, has been constituted under the aegis of the State Institute of Fisheries Technology (SIFT), Kakinada, Andhra Pradesh. The media reports that this arrangement now allows local farmers to place their pricing grievances directly to this panel through their



Shrimp farmers are calling for fairer feed pricing and greater transparency



Training the next generation of aquaculture professionals will be essential as India looks to alternative feed ingredients, stronger productivity and a more resilient shrimp sector

respective regional District Fisheries Offices.

This roll back of ₹4/kg (\$0.05/kg) is seen as a minor concession by the farmers, who have paused stocking new seed and are delaying harvests altogether. By disrupting the processing supply chain and boycotting leading feed brands, the farmers' associations are attempting to pressure feed manufacturers into linking feed costs to real time international shrimp export prices.

Short- and medium-term strategic solutions

Short-term strategic interventions could include a temporary waiver on imports of GM soybean meal. A time-limited and regulated waiver allowing the import of 1.5 million tonnes could be considered, with supplies channelled through state agencies exclusively for aquaculture and poultry feed manufacturing.

Logistics costs could also be reduced by transporting soybean from growing hubs like Madhya Pradesh to coastal feed mills by creating subsidised aquafeed express rail corridors. The APSFIPMC constituted by the Government of

Andhra Pradesh needs to link feed costs to domestic raw material prices and international shrimp export values in order to enable farmers and manufacturers share market risks and rewards more equitably. The Times supports this argument as this will ensure a dynamic, transparent pricing index that has moved away from reactive price caps.

In the medium term, the government must incentivise the feed industry to adopt black soldier fly (BSF) larvae as a direct, locally produced alternative for fishmeal. Efforts must also be

scaled up by the feed industry to use single cell proteins by partnering with biotechnology companies to produce bacterial or algal proteins utilising agricultural waste, reducing dependence on imports from Chile and Peru.

The productivity of non-GM soybeans in India is low. High yielding, pest resistant non-GM varieties should be introduced as soon as possible to boost domestic production and address the current supply deficits.

Long term structural reform

In the longer term, the bargaining power of shrimp farmers must be fundamentally strengthened. Farmers operating on less than two hectares have little leverage when negotiating with large companies or concentrated processing businesses. Large farmer producers' organisations could enable small shrimp farmers to purchase feed collectively at wholesale prices.

Community owned pre-processing and blast freezing centres funded by the Marine Products Export Development Authority (MPEDA) will enable farmers to store their harvests for two or three weeks, reducing the ability of processing plants to artificially depress farm gate prices.

Another option would be tripartite contract farming agreements between farmers, feed manufacturers and exporters reached before ponds are stocked. These agreements could lock in feed costs and farm gate prices, guaranteeing a more predictable margin for smallholders.

In conclusion, short term relief must transition to fundamental re-engineering, strengthening smallholders' bargaining position, diversifying sources of protein for feed manufacturing and ensuring fair market margins throughout the supply chain.

Courtesy: The Fish Site

Khyber Aquaculture Partners with J&K Government to Modernise Trout Farming

Progressive farmers trained in sustainable aquaculture and fish health management

Ganderbal, Jammu & Kashmir, India, 20 August 2026: Khyber Aquaculture, in partnership with the Jammu & Kashmir Department of Fisheries, has launched a specialised training programme to equip local trout farmers with modern, sustainable aquaculture practices. The initiative, part of the Project No

22 Implementation of Trout Cluster Programme covering Ganderbal and Anantnag, under Holistic Agriculture Development Plan (HADP) designed to transform traditional trout farming into a more scientific, efficient, and resilient industry.

The training brought together progressive

farmers from Ganderbal, Bandipora, and Srinagar for an intensive session on "Sustainable Trout Aquaculture and Fish Health Management." Experts guided participants through practical modules on biosecurity, water-quality management, responsible aquaculture, early disease detection, and Recirculating Aquaculture

Systems (RAS). A key focus was shifting from reactive treatment of fish diseases to proactive prevention - emphasising routine water monitoring, stress reduction, and early warning systems to safeguard fish health.

The interactive format also allowed farmers to share real-world challenges and explore practical solutions to improve survival rates, growth, and overall farm efficiency.

Mr Umar Tramboo, CMD, Khyber Aquaculture stated “Capacity building is the cornerstone of a resilient trout sector. By fostering collaboration between farmers, government institutions, and technical experts, we can build a sustainable cold-water aquaculture ecosystem that supports livelihoods, food security, and rural enterprise development in Jammu & Kashmir.”

With its natural mountain conditions, Jammu & Kashmir is uniquely positioned to become a hub for cold-water trout production. By equipping farmers with modern scientific tools, this initiative aims to boost productivity, strengthen value chains, and create new opportunities for rural communities.

This effort reflects Khyber Aquaculture's broader vision to advance India's cold-water fisheries sector through innovation, robust biosecurity systems, and internationally aligned best practices - ultimately positioning India on the global trout and salmon aquaculture map.

Plunging catches and policy delays hit fisheries sector

Fishermen forums are calling for urgent government intervention and a concrete financial relief package, warning that without immediate action, the coastal economy could face a complete collapse.



A file photo of fishermen repair fishing nets in Sakthikulangara Harbour in Kollam

Kollam: August 27, 2026 :

It is almost a month into the post-trawl ban season, a period usually marked by bustling docks and overflowing catches. But a grim shadow of uncertainty hangs over Keralam's coastline as empty nets and grounded boats tell a story of quiet desperation. Barren waters, unrelenting weather bans, and tragic accidents have brought the fishing community to its knees while the promise

of government relief remains out of reach. Both traditional fishers and boat operators say they are caught in a deep economic crisis, facing prolonged periods of unemployment with little clarity on relief or compensation from the government, according to a report in The Hindu recently.

As hostile weather patterns escalate along the coast, fishers point to a growing

gap between official assurances and ground realities. Charles George, State president of the Kerala Matsyathozhilali Aikya Vedi, says overall fish production has dropped drastically. “Catches of staple varieties like sardine and mackerel have dwindled to nominal figures, raising fears of a complete collapse in coming days,” he says. He also points out that nearly 30 days of fishing bans have already been enforced over the past two months alone, leaving workers stripped of their basic livelihood. “The government must urgently announce a concrete financial package for fishers. There is currently a complete lack of clarity surrounding government support,” he adds.

Fishers' Organisations in India Demand Recognition from FAO

Fishermen forums are calling for urgent government intervention and a concrete financial relief package, warning that without immediate action, the coastal economy could face a complete collapse.

Thiruvananthapuram,

August 27: India is ranked the second-largest fish-producing nation globally, accounting for around 8 percent of global output. The fisheries sector in India accounts for nearly 7.43 percent of Agricultural Gross Value Added (GVA), the highest (independent) share among the agriculture and allied sectors.

According to government statistics, India's fish output doubled from 95.79 lakh tonnes in FY 2013-14 to 197.75 lakh tonnes in FY 2024-25, a 106 per cent increase. The Union Budget of 2026-27 proposed ₹2,761.80 crore for the fisheries sector, marking the highest-ever annual budgetary allocation for this sector.

India's “Blue Revolution”, which commenced in 2015 and is backed by central schemes like the Pradhan Mantri Matsya Sampada Yojana (PMMSY), launched in 2020, aims to strengthen the fisheries sector through infrastructure expansion and modern practices.

Yet, in India, the fisheries department at the central level is a part of the



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NET 200 g **BSL**

Probiotics
for water treatment

1. WATER QUALITY CONDITIONING

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



Before



After

3. ESTABLISH BALANCED POND BACTERIA SYSTEM

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

Inhibit the growth of *Vibrio* spp.



Before



After

6. INCREASE AQUACULTURE PRODUCTION

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



* COMPOSITION:

***Bacillus* spp. > 1 x 10¹¹ cfu/kg**
(*Bacillus subtilis*, *Bacillus amyloliquefaciens*, *Bacillus licheniformis*)
Carrier (rice bran, corn gluten) 15%
Moisture 75%
10%

* STORAGE:

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

* DIRECTION OF USE:

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

2. HIGH ACTIVITY OF SPORES

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

3. DECREASE AMMONIA CONTENT

Prevent the accumulation of toxic substances such as NH₃, NO₂, etc.

4. IMPROVE WATER COLOR

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

Eliminate undesirable algae



Before



After

Improve water color



Before



After



Food for Algae & Probiotics



Inorganic matter



Uni-Light PSB



Small molecule organic matter



Nuri BSL



Feces, uneaten feed (protein, starch, cellulose)



Purification of upper and middle layer water



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UNI-LIGHT PSB Function:

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

Quantity	10 - 30 pl/m ² tiger prawn or < 80 pl/m ² Vannameli	For > 30 pl/m ² tiger prawn or > 80 pl/m ² Vannameli	For > 150 pl/m ² Vannameli
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	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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Two fishers at work in Thiruvananthapuram, Kerala, India. Fisheries is a socially and economically important sector for India. Credit: Bharath Thampi/IPS

Ministry of Fisheries, Animal Husbandry & Dairying.

“This needs a revamp, with fisheries being declared an independent sector nationally and regionally,” says the Federation of Indian Fisher Organisations (FIFO).

FIFO, which registered as an official organisation in March 2025, currently has 37 member organisations in India and a presence in every coastal state and union territory. Headed by Vincent Jain, who has worked with unions like the South Indian Federation of Fishermen Societies (SIFFS) in the past, FIFO has approached several Members of Parliament from coastal states, the Fisheries Joint Secretary, the ICAR (Indian Council of Agricultural Research) Director, etc., in the last half-year or so, to present the case.

One of the key structural issues is, Jain says, that funds allotted by the central government get divided into three parts currently, with fisheries ending up with significantly less economic support than it actually needs. It also doesn’t help that many of the policy-makers at the union level don’t belong to coastal states, Jain notes. Yet, there’s an independent sector for agriculture, known as the Ministry of Agriculture & Farmers

Welfare.

Although the Food and Agriculture Organization (FAO) does have a separate “Fisheries & Aquaculture” department under it, in matters of governance, it’s still categorised under the broader “agri-food systems”. Unlike land-based sectors, where violations are often clearly distinguished from livelihood activities, fisheries operate in complex and fluid marine spaces where rules, boundaries, and enforcement mechanisms are not always effectively communicated or practically feasible.

Jain has also reached out to the FAO on behalf of the FIFO, highlighting 30 different aspects to be considered in declaring fisheries as an independent sector. His next step is to have different regional coastal organisations in India, both under FIFO and otherwise, make similar official requests.

Jain suggests that FAO can implement this need by initiating global and regional consultations, calling for expert opinions from fisheries professionals, marine scientists, fisher organisations, labour and safety experts, and policy practitioners with direct field experience. FAO can also develop revised advisory guidelines that are

sensitive to country-specific contexts while promoting best practices in fisheries governance.

“You can look at this in two ways: if we get national recognition as an independent sector, other countries, especially in Asia, may be encouraged to follow suit. At the same time, if an organisation like the FAO acknowledges this need, then it can create a trickle-down effect globally as well,” Jain says.

In India, Jain notes, the government still officially categorises fishers as “farmers”, which is the biggest misrepresentation that FIFO aims to address. This is also influenced by aquaculture being promoted in this century. Even though advisory committees in India include experts with fisheries backgrounds, final decisions are often shaped by administrative perspectives that neglect the needs of fishers.

As a result, fisheries schemes have been poorly aligned, overlook safety and operational risks at sea, underestimate capital and infrastructure requirements, or fail to address post-harvest and market challenges unique to the sector.

Moreover, fishers don’t have a regulated system of provident fund or insurance schemes, which the government has mandated for daily wage workers across the country.

Sebastian Mathew, a fishery advisor who retired from the International Collective in Support of Fishworkers (ICSF), has a slightly differing perspective on the issue, though. Unlike agriculture

and farming, fishing is a declining “traditional” livelihood generally in India, he says. There are fewer people in this century who are carrying the trade forward from their previous generation and are seeking alternative occupations instead.

There’s also substantial loss of traditional knowledge as a result of this, Mathew reckons. While this phenomenon is applicable for agriculture as well, he feels it’s more pressing when it comes to fishing.

“Also, when we talk about better resource allocation for fisheries centrally, we need to reflect on how well the current funds are being utilised, especially by the state governments. Except for aquaculture, are we really promoting artisanal fishing practices and using our finances wisely for that?” he adds.

One of the fishers’ unions in Sri Lanka has expressed interest in joining FIFO in this movement, Jain says. He has also reached out to representatives of several Asian and European countries who rely on the fisheries sector to a large extent, just like India.

This movement is distinctive from other campaigns by the fishers’ unions and organisations in the past, Jain points out, because of the official route chosen to highlight the issue rather than demonstrative protests or agitations.

The organisation is also planning to conduct a national-level workshop where experts and representatives of coastal communities can present their ideas on this matter.

Courtesy by Global Issues

JAPFA STP Strengthens India's Aquaculture Future Through Make in India Aqua Feed Partner Conferences 2026

The successful completion of the **JAPFA STP Make in India Aqua Feed Partner Conferences 2026**, held on **29th July 2026 at Renaissance Lucknow Hotel, Lucknow**, and **30th July 2026 at Novotel Vijayawada Varun, Vijayawada**, marked a significant milestone in our continued commitment to advancing India's aquaculture industry. Bringing together key stakeholders from across the value chain, the conferences served as dynamic platforms for meaningful engagement, technical exchange, and strategic collaboration, reinforcing JAPFA STP's vision of building a stronger, more sustainable future for aquaculture in India.

As India's aquaculture sector continues to evolve and emerge as a critical contributor to food security, rural livelihoods, and economic growth, the need for innovation-led partnerships has never been greater. Recognizing this opportunity, JAPFA STP hosted these partner conferences to facilitate



Ardi Budiono, President Director of PT Suri Tani Pemuka (STP), Aquaculture Division of JAPFA Group addressing

dialogue among industry leaders, entrepreneurs, distributors, farmers, and aquaculture experts, creating an environment where knowledge and experience could be shared to address both current challenges and future opportunities.

A key highlight of the events was the participation of distinguished JAPFA leaders and global aquaculture experts, including **Mr Ardi Budiono**, President Director of PT Suri Tani Pemuka (STP), Aquaculture Division of JAPFA Group; **Dr Erwin Suwandi**, Head of Aquafeed (International Division)

and Head of Nutrition & Feed Technology, STP Indonesia; **Dr Albert G.J. Tacón**, Founder/Owner



Dr Amiya D. Nath, Country Head, JAPFA STP India.

of Aquahana™ LLC and Consultant to JAPFA STP Indonesia; and **Dr Amiya D. Nath**, Country Head, JAPFA STP India. Their presence brought valuable

international perspectives and technical expertise to the discussions, underscoring JAPFA STP's unique strength of combining decades of global aquaculture experience with a deep understanding of local market needs. Through interactive sessions, technical presentations, and strategic discussions, participants gained valuable insights into advancements in feed nutrition, sustainable farming practices, production efficiency, and market-driven growth strategies.

The conferences also reinforced the importance of the **Make in India** initiative in transforming the aquaculture value chain. At JAPFA STP, we firmly believe that world-class manufacturing capabilities within India, supported by global expertise and innovation, are essential to delivering superior nutritional solutions that drive productivity and profitability for fish and shrimp farmers.



Dr Erwin Suwandi, Head of Aquafeed (International Division) and Head of Nutrition & Feed Technology, STP Indonesia

By investing in local manufacturing excellence and maintaining international quality standards, JAPFA STP



JAPFA Indonesia and India teams at Lucknow



*Dr Albert G.J. Tacon,
Founder / Owner of Aquahana
LLC and Consultant to JAPFA
STP Indonesia*

continues to empower farmers with reliable, high-performance feed solutions tailored to India's diverse aquaculture requirements.

Beyond technology and products, the events highlighted the critical role of partnerships in driving industry progress. The participation and engagement of our valued distributors and business partners reflected the strong relationships that form the foundation of our growth journey. Open discussions around market trends, customer expectations, operational excellence, and future opportunities enabled stakeholders to align on common goals and strengthen collaborative efforts aimed at creating long-term value across the aquaculture ecosystem.

The conferences further emphasized JAPFA STP's focus on sustainability as a core pillar of business growth. With increasing awareness around responsible aquaculture practices, discussions explored ways to enhance resource efficiency, improve farm performance, and support environmentally responsible production systems. By integrating innovation, scientific nutrition, and sustainable

practices, JAPFA STP remains dedicated to helping farmers achieve higher productivity while contributing to the long-term health and resilience of the industry.

For many participants, the events provided an opportunity not only to gain technical knowledge but also to connect with peers, exchange experiences, and explore new avenues for collaboration. Such interactions are essential for fostering innovation and enabling the industry to collectively address emerging challenges. The positive response and active participation from all



Participants during the Conference

attendees demonstrated the industry's shared commitment to continuous learning, improvement, and growth.

The successful hosting of the conferences in both northern and southern India reflects JAPFA STP's commitment to strengthening its presence across key aquaculture regions and supporting the diverse needs of farming communities nationwide. By creating platforms that encourage collaboration and knowledge sharing, JAPFA STP continues to play an active role in shaping the future of Indian aquaculture.

As we reflect on the success of the JAPFA STP



JAPFA Indonesia and India teams at Vijayawada

Make in India Aqua Feed Partner Conferences 2026, we extend our heartfelt appreciation to all partners, stakeholders, customers, and industry experts who contributed to making these events impactful and memorable. Your trust, engagement, and continued support inspire us to push boundaries, embrace innovation, and

create sustainable value for the industry.

The journey ahead presents immense opportunities, and JAPFA STP remains committed to being a trusted partner in that transformation. Together, through innovation, quality, collaboration, and a shared vision for excellence, we are building more than just a stronger feed business. We are helping create a stronger, more resilient, and more prosperous future for aquaculture in India.

Together, we're not just delivering feed. We're creating a stronger future for aquaculture



Presentation of the Premium Distributor Award to valued customer



Team JAPFA

Competition in shrimp production from Equador & other countries, Antibiotics, Low Domestic shrimp consumption affecting Indian Aquaculture sector

Sri Sai Rama Frozen Foods makes a mark in Aquaculture with Multiple activities in different places in India; the group achieves business turnover of Rs 500 crore

Kakinada:

Mr L. Satyanarayana, known as Abbu, Director, Sri Sai Rama Frozen Foods Pvt Ltd said that feed quality is equal with all feed manufacturers in India, it is the seed quality which differs from hatchery to hatchery which is causing losses to the farmers. Farmers also do not know how to do the culture to make successful crop. Many farmers in Andhra Pradesh are not following good management practices in ponds and drainage system besides selection of quality seed, he stated.

Farmers should not use medicines unnecessarily which leads to problems. 90 percent of medicines and antibiotics available in the market are duplicate and are not of quality which is damaging the crop. India's name in shrimp exports is damaged in the international market due to usage of antibiotics, Mr Abbu told. We have very good sea water in Andhra Pradesh and it should be utilised properly.

Started with trading in 1998 in Aqua

Abbu entered into aquaculture trading in 1998 with purchase of shrimp raw material and supplied it to exporters. Next, he entered into shrimp culture with 500 acres till recently, and now reduced it to 150



L. Satyanarayana (Abbu), Director, Sri Sai Rama Frozen Foods Pvt Ltd, Kakinada

acres. He gets three tonnes of shrimp production per acre and annually producing 450 tonnes.

Sri Sai Rama Frozen Foods activity

1. Shrimp raw material purchase.
2. Shrimp farming in 150 acres producing 450 tonnes material annually.
3. Hatchery with 850 million seed production annually.
4. Two Ice factories at Bhimavaram and Amalapuram.
5. Shrimp processing plant, Snow World, with 100 tonnes processing capacity per day at Balasore, Odisha.
6. Merchant exporter from Visakhapatnam (Sprints Exports).
7. Raw Material purchase from all over India with offices at Kakinada, Amalapuram, Malkipuram,

Bhimavaram, Ongole, Nellore, Surat in Gujarat and Tamil Nadu.

8. Dealers for the feed of Avanti, Sandya Aqua, Deepak Nexgen, Sandhya Marines. Also healthcare products of Blue Bell, GMD Healthcare etc.

The group has achieved annual business turnover of Rs 500 crore.

Abbu who has 24 years of experience in aquaculture sector said that this sector is facing (3) three problems such as Antibiotics, Competition from other countries like Equador for shrimp raw material supply and very low consumption of shrimps in India. Besides these factors, higher import duty / taxes from America as India totally depended on America, and the war in West Asia. Farmers are also badly hit with higher power tariff, he added.

Aqua International plays effective role

Abbu appreciated that Aqua International magazine is playing effective role in communication and became a bridge among the stakeholders of the industry, and between the industry and the government.

Solutions:

We expect 2027 would be

a good year for shrimp sector in India. Farmers should ensure proper drainage system at ponds and manage the ponds well. Hatcheries should be honest enough and provide quality seed, he stated adding that usage of probiotics will help to produce healthy shrimps.

Four Directors:

Sri Sai Rama Frozen Foods has four Partners / Directors such as:

L. Satyanarayana (Abbu).

N. Ramakrishnam Raju.

K. Rajendra Prasad.

K. Subba Raju.

The group has about 200 employees working all over India.

Abbu's son Mr Vireen Manas died in 2024 in an accident and adopted a female baby Amoghasree, 2 years old.

10 years back, with only raw material trading Sri Sai Rama Frozen Foods had Rs 1,500 crore business turnover and now it came down to below Rs 500 crore due to diseases in shrimp culture and less raw material availability. Number of shrimp exporters has gone up and shrimp material shortage is happening causing viability issues to the exporters, he told.



We have a mission to provide India with best shrimp genetics of Hendrix Genetics, Kona Bay

I am glad to see our investments in R&D and selecting for shrimp for India's environment are showing success, and we are ready to take the first position once again – Jarl van den Berg

Mr Jarl van den Berg, Managing Director, Hendrix Genetics, Kona Bay visited India for one week from 24 to 29 August 2026 and travelled different shrimp producing places, talked to leading hatchery owners, farmers and technical experts in India. Aqua International Editor M.A. Nazeer met him at Bhimavaram, Andhra Pradesh on 25 August 2026 along with his Kona Bay team in India and had an interview with them.

Kona Bay Balance Pro is our latest product launched in India in January 2026. We started supplying Kona Bay broodstock sourced from Hawaii on August 1, 2026. We are strongly focused on R&D and genetic improvement to develop high-performing genetics specifically suited to Indian climatic and farming conditions, said Mr Jarl van den Berg.

Currently, Kona Bay broodstock is available at Vaisakhi, CP, Coastal (Ongole), Tejaswi, Mahadeva, Kanakamatsya and KKR Hatcheries. We are observing better farming performance with Balance Pro compared with the Balance Line, based on



*Jarl van den Berg,
Managing Director, Hendrix
Genetics, Kona Bay*



*Y. Ravi Kumar, Managing
Director, Vaisakhi Marine
Resources Pvt Ltd addressing
the meet at Bhimavaram*

field observations and farmer experiences. Our primary goal is to bring best genetics to India and help farmers achieve better performance, profitability, and long-term success, he added.

Aqua International: Please tell us about yourself ?

Jarl van den Berg: We are Kona Bay, a shrimp SPF breeding company based in Hawaii and proud subsidiary of Hendrix Genetics, a leading research and development enterprise for the improvement of animal genetics to provide a solution to the global

All our success is attributed by the investment in our R&D programs, and the dedication of our team to support the hatchery operators and shrimp farmers, said Mr Jarl van den Berg, Managing Director, Hendrix Genetics, Kona Bay along with Mr Deepak Patnaik, Commercial Director - Shrimp, and Dr Rushi R.K., Sales Manager - Shrimp, Hendrix Genetics, Kona Bay recently in an interview by M.A. Nazeer, Editor, Aqua International, English monthly.

food challenge. Kona Bay India is managed under the leadership of Mr Deepak Patnaik with the support of Dr Rushinadha Rao Kakara and Anjaneyulu Kuppam. The Kona Bay global company is managed by Mr Jarl van den Berg since April 2026, who is the son of the founder of Hendrix-Genetics. Jarl previously provided commercial expertise for the Salmon and Trout breeding division.

NBC, production facilities of Kona Bay

Kona Bay has the Nucleus



*Dr Naomi Duijvesteijn,
Hendrix Genetics, Kona Bay*

Breeding Centre in Hawaii (NBC), and has two Breeding Multiplication Centres (BMCs) in Hawaii and Indonesia.

AI: Key Persons of Kona



Kona Bay Broodstock



Kona Bay team, Y. Ravi Kumar and M.A. Nazeer during farmers meeting in Bhimavaram, A.P. on 25 August 2026

Bay Hendrix Genetics

Jarl van den Berg: In addition to the team mentioned previously, the operations in Hawaii are



*Deepak Patnaik,
Commercial Director, Hendrix
Genetics, Kona Bay, India*

managed by Mr Rodney Corpuz, and the facilities in Indonesia by Mr Ari Setiardi. The breeding program is developed by a dedicated team of 4 geneticists of Hendrix Genetics under the leadership of Dr Naomi Duijvesteijn.

AI: Do you have R&D facilities? If so, how are the results of R&D?

Jarl van den Berg: We maintain our nucleus program in Hawaii, where we collected the first set of data. Depending on our products we have challenge trials, disease trials, and sentinel (in-field) trials which we conduct in labs or customer farms across Europe and Asia. This way we continuously select our lines in Hawaii with the information from the performance where it matters. This is the power of genomic selection.

AI: Which are the top five basic Shrimp Broodstock Companies globally? What is the market size and position of Kona Bay in the world shrimp culture sector with regard to shrimp Broodstock production and

supply? What is the world shrimp Broodstock market size and what is your share in it globally and in India?

Jarl van den Berg: Depending on the country, the dominant brood supplier changes. In India, we share the market with Shrimp Improvement Systems and SyAqua who have a good team, shrimp and have had a strong market presence in recent years. I am glad to see our investments in R&D and selecting for shrimp for India's environment are showing success, and we are ready to take the first position once again. Our unique value is that we remain independent and purely focused on genetics. All other shrimp broodstock companies are either vertically integrated (i.e. selling PLs or having grow-out ponds) or horizontally integrated (i.e. selling hatchery feed, grow-out feed, probiotics etc.). This will limit the flexibility available for the hatcheries, nurseries and grow-out farmers. We look to remain an independent broodstock supplier simply focused on delivering the best quality genetics.

AI: Role and importance of Broodstock in shrimp

aquaculture sector?

Jarl van den Berg: There is no shrimp aquaculture without the genetic companies. An entire industry depends on us to make sure we do not make a mistake, and we continuously improve, so the farmers get better results.

AI: How many varieties of shrimp seed you are producing? What is the variety of shrimp seed you are supplying to Indian market?

Jarl van den Berg: We got four core products,



*Dr Rushinadha Kakara,
Sales Manager, Shrimp, Hendrix
Genetics, Kona Bay, India*

Speed, Strength, Balance and now the new product Balance Pro. The Balance Pro is the primary product of focus for us in India which delivers fast growth to make sure the growers achieve break-even quickly, and then the resistance to keep the trend until a desirable market size. We are also excited about future products in our pipeline.

AI: How many countries you are exporting your broodstock worldwide?

Jarl van den Berg: We supply our broodstock to North America, Europe, Middle East, Asia – unfortunately not Latin America due to transit time



Kona Bay brochure releasing



Deepak Patnaik presenting a Bouquet to Y. Ravi Kumar

from our locations. We look at changing this in the future.

AI: How is the satisfaction level of your products (broodstock) from the customers globally and in India ?

Jarl van den Berg: We have always seen a good presence in RAS and high growth segments, but lost significant market share due to our lack of focus in EHP / WFD few years back. With our new product line, and our pipeline of investments we intend to provide our customers with more variety suitable for every unique environment.

AI: To which aspects do you attribute your progress, growth and success ?

Jarl van den Berg: All our success is attributed by the investment in our R&D programs, and the dedication of our team

to support the hatchery operators and shrimp farmers.

AI: What are your future plans and targets ?

Jarl van den Berg: We have a mission to provide India with the best shrimp genetics. We have as a vision to set the standard of the most sustainable shrimp breeding in India – and our values are

dedicated to the team, the shrimp and the farmers. We got here to provide value – and I can tell the readers that shipping large mature broodstock from the USA is not the future. It costs too much in freight, and it doesn't create independence or food security. We have exciting plans that we are discussing with hatcheries to make sure we provide

There is no shrimp aquaculture without the genetic companies. An entire industry depends on us to make sure we do not make a mistake, and we continuously improve, so the farmers get better results.

the best seed for the Indian farmers.

AI: Would you comment on the present issues and trends in aquaculture industry in India and other parts of world ? What solutions do you suggest for sustainable growth and development in aquaculture sector globally and in India ?

Jarl van den Berg: I worried for India. The fuel prices, electricity prices, feed prices are all increasing, but the shrimp farm gate prices have declined. Add to this,

the increasing pressures and uncertainty of pathogens that could affect the crop. It is not good. As an industry we need to make sure that everybody gets SPF Broodstock, High



Dr Rushinadha Kakara presenting a Bouquet to Jarl van den Berg

quality seed and most importantly shrimp farmers investing in their farms to improve biosecurity and productivity.

AI: Do you have any message to shrimp farmers to get better performance and production from the seed, and also to hatcheries who import your broodstock ?

Jarl van den Berg: The only results that matter are those on your own farm. Try different genetics, try different seed, and see what works for you. Contact your hatchery,



An young farmer raising a point about Kona Bay seed



Kona Bay team with three best performing farmers with Kona Bay Balance Pro seed

or the genetic supplier to see what product is best for your environment. Every farmer, every farm is different. What aim to do is make sure there are more products available, and have more technicians help improve. Our vision is to set the standard for shrimp breeding, and we do this through improving your performance every new crop.

PROXY[®] PS

with Photosynthetic Formula
POND CONDITIONER



A Unique Combination
of Live Multi-strain
SOIL and WATER Probiotic

CAA Regn. No. CAA/MAY18/PRO/01684

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- Growth of Plankton
- Controls Body Cramp
- Pond Water Mineralization
- Shell Formation



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Cust. care No.: +91 97010 22555
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OME Enterprises deals with 20 feed, over 100 Healthcare Cos, Its a record in Indian aquaculture sector



*Ravi Pericherla,
Founder & Managing Partner,
OME Enterprises*

Our decision to maintain an extensive portfolio featuring over 20 top-tier feed manufacturers and more than 100 registered health, nutrition, and probiotic companies is a deliberate, strategic, and farmer-first choice, said Mr Ravi Pericherla, Founder & Managing Partner, OME Enterprises, in an interview with M.A. Nazeer, Editor, Aqua International, English monthly.

In the dynamic and high-stakes landscape of Indian aquaculture, true success is measured not merely by tonnage or volume, but by the strength of relationships built along the way and the enduring trust established with every farmer on the ground. The story of OME Enterprises stands as a powerful testament to what can be achieved when steady, time-tested discipline meets modern, forward-thinking innovation—a journey anchored by the deep industry roots of founder Mr Ravi Pericherla and accelerated by the modern leadership of his son, Mr Avinash Pericherla.

"True success in aquaculture is measured not merely by crop volume, but by the lasting trust built with every farmer on the ground", said Mr Ravi Pericherla.

Mr Ravi Pericherla's journey in aquaculture spans over three decades of dedicated, hands-on service. Stepping into the

aqua sector in 1994, he spent 15 formative years honing his craft within a partnership firm focused on registered aqua feed and healthcare products distribution across coastal Andhra Pradesh. During this period, he acquired



*Avinash Pericherla,
Partner, OME Enterprises*

an intimate, ground-level understanding of pond biology, supply chain logistics, crop risks, and the economic realities faced by farmers. In 2009, backed by rich field experience, clear market vision, and an uncompromising commitment to product authenticity, Mr Ravi founded OME Enterprises in Amalapuram. Driven by core growth pillars—

relentless work ethic, exemplary communication, uncompromising discipline, and an unwavering farmer-centric focus—he built the company from the ground up.

P. Avinash Pericherla, the son, joins family business

To sustain and scale this growing enterprise, the company welcomed Mr P. Avinash Pericherla, introducing a powerful blend of modern technological acumen and strategic corporate management. After earning his B.Tech degree from the prestigious Dhirubhai Ambani Institute

of Information and Communication Technology (DA-IICT) in Ahmedabad, Avinash secured a coveted corporate role in the software industry with a lucrative remuneration package. However, driven by a strong entrepreneurial passion and a deep desire to transform rural aquaculture, he chose to return home. Under the direct mentorship of his father, Avinash spent years mastering the nuances of field operations, feed science, and supply chain dynamics, transitioning seamlessly from a hands-on trainee to a core driving partner.

Today, OME Enterprises represents a perfect multi-generational synergy: the decades-deep wisdom and battle-tested field experience of Mr Ravi Pericherla combined with the digital innovation and strategic foresight of Mr Avinash Pericherla. This synergy has cemented OME Enterprises' leadership status, earning it the top position in the East Godavari District of Andhra Pradesh as a premier distributor of aqua feed and healthcare products, he stated.

Aqua International: Multi-Brand Portfolio: Why Deal with 20+ Feed companies &



A view of Feed Warehouse



A view of OME office

100+ Healthcare Brands ?

Mr Ravi said, our decision to maintain an extensive portfolio featuring over 20 top-tier feed manufacturers and more than 100 registered health, nutrition, and probiotic companies is a deliberate, strategic, and farmer-first choice.

Tailored Solutions for Micro-Conditions

Water parameters, salinity levels, soil conditions, and disease pressures vary significantly from pond to pond across East Godavari. No single product or brand offers a universal solution. A broad portfolio allows us to prescribe exact, customized protocols based on specific pond ecology.

Farmer Autonomy & Choice

We believe in empowering the farming community. Offering a complete spectrum of trusted national and international brands ensures farmers can access their preferred, proven formulations under one roof without operational bottlenecks.

Unbiased Quality Advocacy

Because we are not tied exclusively to a single brand, our field recommendations remain unbiased, scientifically

sound, and focused entirely on maximum yield for the farmer.

What are the positive and best aspects you have for your company and for customers ?

- For our Customers: Unlike single-brand agencies, we partner with over 20 top-tier feed manufacturers and 100+ registered healthcare and nutrition companies. Because soil, salinity, and water parameters vary significantly across East Godavari, no single product works everywhere. We give farmers complete freedom to choose the exact, customized formulations best suited for their specific pond conditions.
- For our Company: This vast portfolio protects our business from single-brand supply chain disruptions and reinforces our position as a neutral, trusted advisor rather than a push-sales distributor.

Did you get any motivation and inspiration from any one or institutions which helped you to do well, grow and achieve ? Milestones in your career and life ?

Our primary inspiration comes directly from the coastal farming community of Andhra Pradesh. Witnessing the hard work, risk-taking capacity, and perseverance of local aqua farmers through market fluctuations, extreme weather, and biological challenges inspired us to build a company that acts as a reliable shield for their livelihoods.

Industry Challenges & Practical Solutions

Having monitored the evolution of coastal aquaculture over three decades, OME Enterprises

identifies critical structural challenges facing today's farmers and offers concrete, actionable solutions:

Industry Challenge	Root Cause	Advised Solution
High Financial Risk & Crop Loss	Premature physical expansion into larger acreage without technical mastery or adequate operational capital.	Density over Acreage: Shift focus from expanding farm acreage to maximizing yield density and water quality on existing ponds through bio-secured management.
Rising Input Costs & Margin Squeeze	Inefficient Feed Conversion Ratios (FCR) caused by overfeeding, unmonitored bottom health, and poor feed management.	Precision Feeding: Implement strict check-tray monitoring, automated feeding systems, and high-digestibility feeds to keep FCR low and profits high.
Disease Volatility & Water Quality Deterioration	Over-reliance on chemical treatments after disease outbreak occurs, rather than preventative soil and water management.	Proactive Biosecurity: Regular soil-water testing, structured probiotic protocols, sludge management, and stress reduction through tailored nutrition.
Market Price Fluctuations	Unplanned harvests occurring simultaneously across clusters, forcing panic selling at lower farm-gate prices.	Phased Crop Planning: Staggered stocking strategies, adherence to real-time market updates, and maintaining crop health longer to target favorable weight brackets.



A view of Shrimp Ponds of Ravi Pericherla



Your Message to Stakeholders ?

- **To Farmers:** "Do not chase land expansion at the expense of management quality. Focus on maximizing culture health, biosecurity, and feed efficiency in your existing pond area. Sustainable density yields far higher profitability with

manageable financial risk than unmanaged large-scale farming."

- **To Industry & Manufacturers:** "Innovation must remain practical and cost-effective. Focus on delivering stable, transparent, high-efficiency formulations that help small and medium farmers lower their cost of production per kilogram of shrimp."
- **To the Government & Policy Makers:** "Continued support in power subsidies, timely testing lab infrastructure at the mandal level, quality

control of imported broodstock/PLs, and strict monitoring of unaccredited inputs will safeguard the livelihood of millions reliant on Andhra Pradesh's aquaculture economy."

Your Future Plans & Growth Targets ?

Starting with an initial handling capacity of 250 to 500 metric tonnes in feed and healthcare products, OME Enterprises scaled through sheer perseverance to an impressive 25,000 metric tonnes within 15 years. Moving forward, the company is executing a clear roadmap for its next



phase of growth.

- **Targeting 40,000 Metric Tonnes:** Driven by technology integration, expanded rural retail touchpoints, and enhanced farmer-support programs, OME Enterprises aims to reach an annual handling capacity of 40,000 metric tonnes of feed within the next 2 to 3 years.

Linga Raju Promoting Polyculture

Gopavaram, A.P.:

Polyculture is developing well in Kakinada, Konaseema districts in Andhra Pradesh. Till recently it was 70% Prawn culture and 30% Polyculture, and now both became equal in culture expansion in coastal area of Andhra Pradesh, informed Mr M. Linga Raju, Proprietor, Sri Vengamamba Aqua Agencies here. He supplies polyculture feed for fish as

well as shrimp farmers.

Polyculture feed market is growing slowly as end product rates for fish is Rs 120 per kilo where as shrimp material price is Rs 230 to Rs 250 per kilo for 100 count prawn. Next to shrimp culture polyculture is taking roots. Polyculture is growing well in Andhra Pradesh, Telangana, Maharashtra and Gujarat states, he stated.

Polyculture is more where

land lease cost is low. In scientific aqua farms the usage of feed is 36 protein and in polyculture it is 30 protein feed.

Linga Raju started his business in aquaculture in 2017 with healthcare products and later has taken up polyculture feed of Falcon Feeds, Harsha Teja and Crescent Aqua Solutions, and serving for polyculture development.

If our farmer customers are happy with end product rates, we will be happy with our returns, Linga Raju told.

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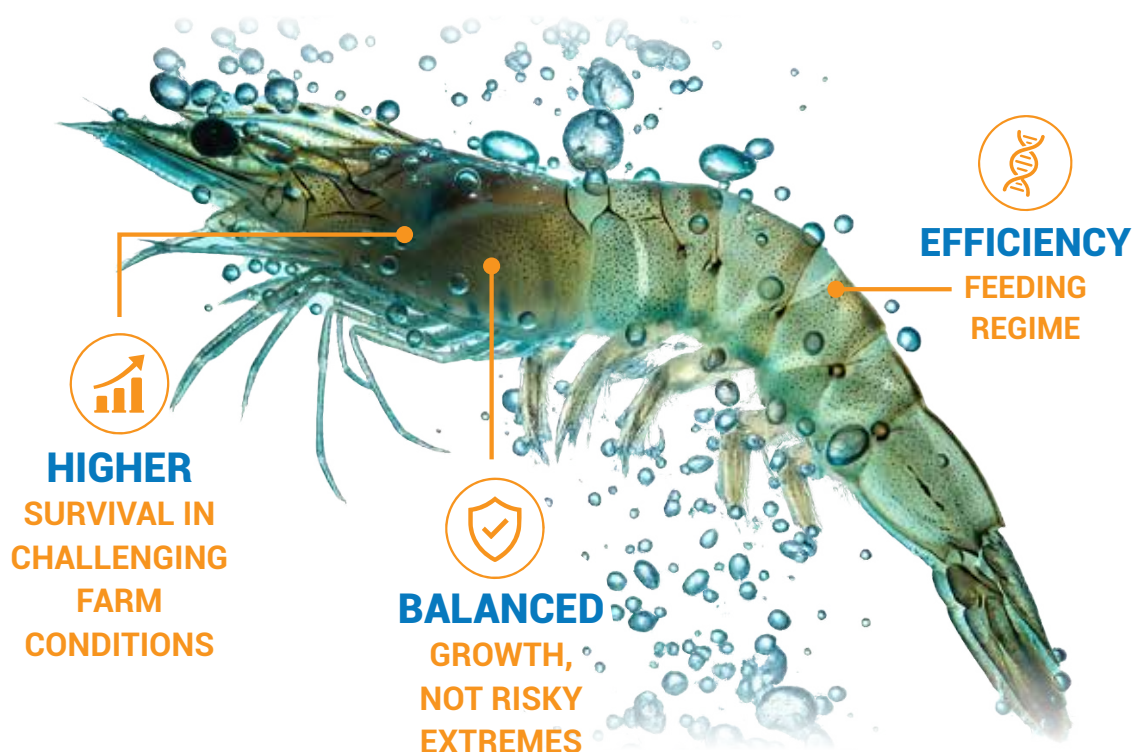


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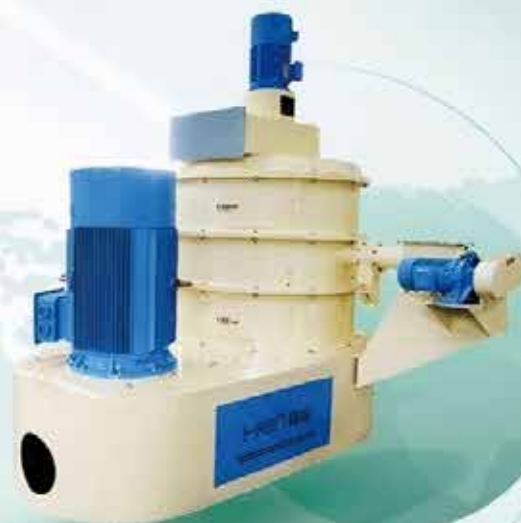
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Rainy Season Readiness: An Adaptive Approach to Shrimp Pond Management

Understanding environmental change and responding to the shrimp

By Dr Natthinee Munkongwongsiri and Dr Pajaree Jueliang, SyAqua



*Dr Natthinee Munkongwongsiri
Associate Director of Research &
Technical Transfer, SyAqua*

The rainy season is one of the most challenging periods in shrimp farming. Production losses are often attributed to rainfall itself; however, rain is only the initiating event. The real challenge lies in the rapid environmental changes that follow, including reductions in temperature and salinity, fluctuations in dissolved oxygen (DO) and pH, changes in phytoplankton and microbial communities, and increased physiological demands on shrimp. These changes can challenge shrimp resilience and may create conditions that favor opportunistic problems (Buike, 2018; Huang et al., 2026).

Successful shrimp farming during the rainy season depends on anticipating environmental changes and adapting pond management early. This article explains the biological mechanisms

behind rainy-season production challenges and provides a practical framework for adjusting management according to how the pond and shrimp respond.

Why is the rainy season so challenging?

Shrimp live entirely within their aquatic environment, so rapid changes in water quality directly influence their physiology and behaviour. Heavy rainfall can dilute salinity and alkalinity, lower water temperature, alter pH and DO, increase turbidity and disturb phytoplankton stability. Freshwater can also remain temporarily above more saline pond water, creating stratification until the pond is sufficiently mixed (Buike, 2018). The combination of simultaneous changes can place considerable physiological and ecological pressure on the production system.

Farming failure events during the rainy season

SyAqua's 2025 commercial farm database shows a seasonal pattern in reported farming-failure events. Event counts increased from June and were highest from July to September, overlapping with the rainy season in several major shrimp-producing regions represented in the database. Health-related reports during this



*Dr Pajaree Jueliang
Technical Support Manager, SyAqua*

period included high mortality, RMS and WSSV, alongside unknown and business-related causes of unsuccessful farming.

The data indicate an association between the rainy period and increased reported events, while the environmental mechanisms described below provide a plausible context for why this period deserves increased management attention.

What happens after heavy rain?

Heavy rainfall introduces freshwater into the pond, reducing surface salinity and potentially creating temporary water-column stratification. Acute salinity reductions require Pacific white shrimp to make osmoregulatory and metabolic adjustments (Bückle et al., 2006; Wang et al., 2015). Cloudy weather and lower temperature can also alter metabolism, digestive activity and feeding response. At the same time, reduced sunlight limits phytoplankton photosynthesis, lowering daytime oxygen production and altering the normal pH cycle.

If feed input remains higher than the shrimp can consume, uneaten feed, faeces, dead phytoplankton and other organic material can accumulate. Higher feed inputs increase nutrient

Parameter	Typical response after heavy rain
Temperature	May decrease rapidly
Salinity	Declines through freshwater dilution
DO and pH	May decline or become unstable
Alkalinity/minerals	May decrease through dilution
Phytoplankton	Photosynthesis and bloom stability may decline
Organic matter/ microbes	Distribution, decomposition and community structure may change

and organic loading and oxygen demand, raising the risk of low DO and water-quality deterioration (Jescovitch et al., 2018). Together, changes in salinity, temperature, DO, phytoplankton and microbial balance can increase physiological demands on shrimp. The key concern is therefore the cascade of changes following rainfall, rather than rain as an isolated event.

Feeding management during the rainy season

Feeding programs provide a baseline for expected growth and consumption under relatively stable conditions (Figure 3). During heavy rain or rapid environmental change, actual feed demand may temporarily differ from the standard program. A rapid temperature decline can alter metabolic and digestive activity and may change feeding response. SyAqua data indicate that feed demand may decline by approximately 3–5% for each 1°C reduction from 30°C to 20°C; this should be treated as a practical reference and confirmed against actual pond appetite rather than applied as a fixed rule.

The objective is not to reduce feed automatically whenever it rains. Farmers should integrate weather, temperature, DO, salinity, check-tray response, shrimp activity and

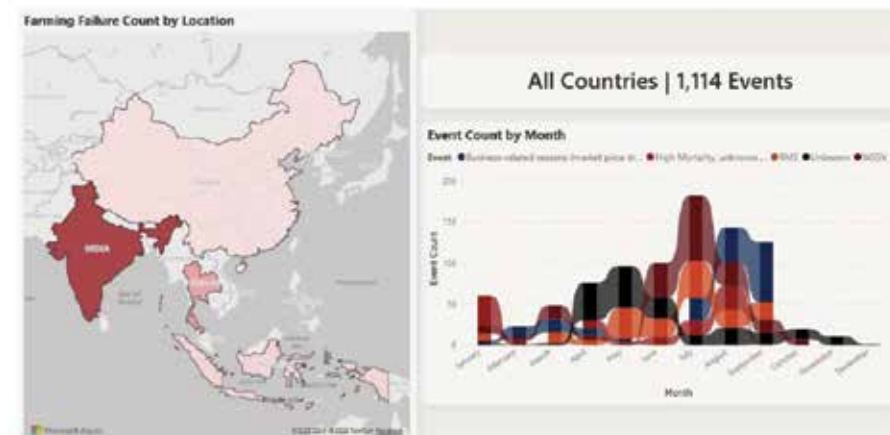


Figure 1: Farming-failure events by month in the 2025 SyAqua commercial farm database.

bloom condition. If appetite remains normal, an automatic feed reduction may not be necessary. When several warning signs occur together—such as reduced appetite, falling temperature and declining DO—a more conservative feeding response is appropriate.

Maintaining pond stability beyond feeding

Feeding adjustment is only one part of rainy-season management. Aeration and water circulation are particularly important when reduced photosynthesis, increased oxygen demand and temporary stratification occur. Adequate mixing can help maintain DO and restore more uniform pond conditions. Water-quality trends—including

salinity, pH, alkalinity, DO and water colour—should be followed closely. Management should consider the direction and magnitude of change rather than reacting aggressively to a single measurement.

Phytoplankton stability also deserves attention during prolonged cloudy weather. A marked change in water colour, reduced daytime pH increase or declining DO may indicate bloom instability. Under these conditions, priorities are to maintain oxygen availability, avoid unnecessary organic loading and monitor the pond closely until conditions stabilise.

Many practical measures for preparing shrimp farms for heavy rainfall are already well established.

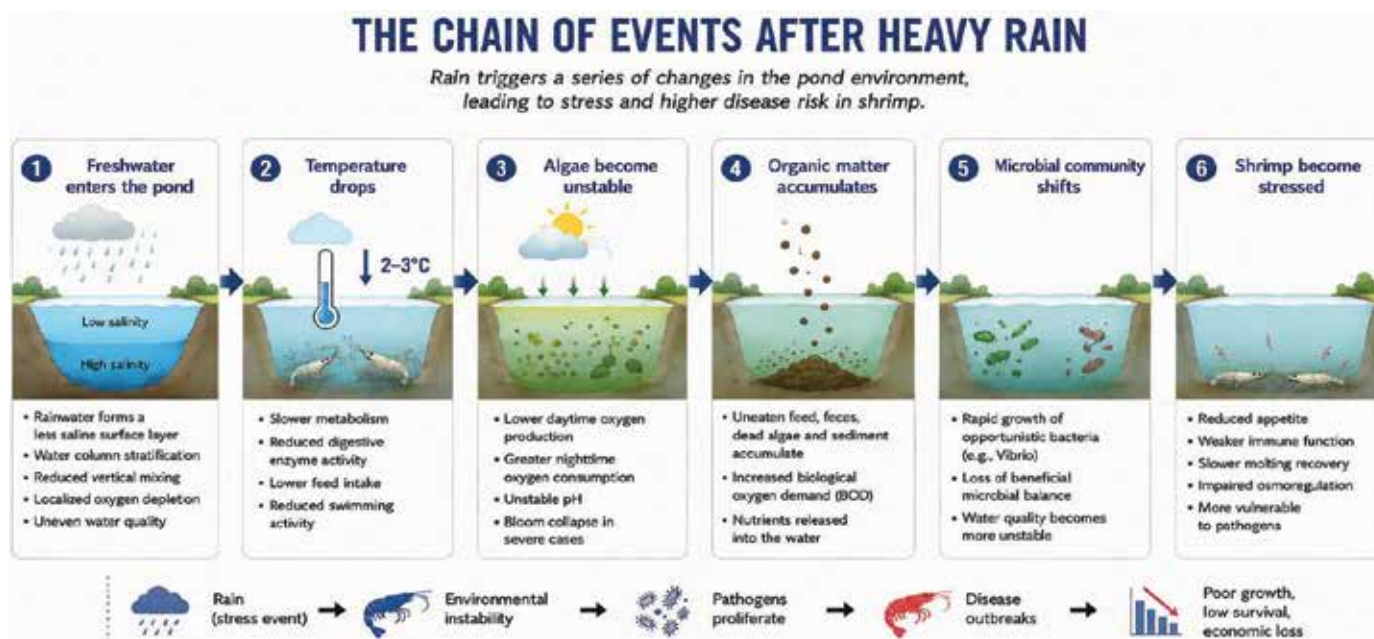


Figure 2: Simplified chain of pond changes following heavy rainfall, from freshwater input and environmental instability to increased physiological stress on shrimp.

Practical feeding adjustment

Observe	If observed	Management response
Forecast/rainfall	Heavy rain or prolonged cloud cover	Hold or trim the scheduled amount; reassess before the next meal.
Temperature	Rapid decline, especially $\geq 2^{\circ}\text{C}$	Adjust to appetite; return gradually as temperature and feeding recover.
DO	Declining or near the farm's lower limit (e.g. ≤ 4 ppm)	Reduce or delay feed, increase aeration and reassess.
Salinity	Rapid decline from normal (≥ 5 ppt per day)	Avoid increasing feed; observe shrimp activity and appetite.
Check tray	More feed remains than usual	Reduce the next feeding and continue adjusting to consumption.
Check tray	Normal consumption despite rain	No automatic reduction; maintain cautiously and continue monitoring.
Bloom/pH	Rapid water-colour or pH-pattern change	Avoid aggressive feed increases; monitor DO, pH and alkalinity.
Multiple signs	Low appetite + temperature/DO/bloom change	Use a stronger reduction or temporary delay; prioritise pond stabilisation.

These include maintaining drainage and dyke conditions, ensuring adequate aeration capacity, monitoring key water-quality parameters, adjusting feeding during unstable conditions, and maintaining aeration until pond conditions and phytoplankton recover (Buike, 2018). These practices remain important foundations of rainy-season management.

Building on these established practices, greater emphasis can be placed on farm readiness, trend-based decision-making, health preparedness and learning from each rainfall event.

Additional Emphasis for Adaptive Rainy-Season Management

Rainy-season management is ultimately about understanding how each pond responds to environmental change. Established practices such as maintaining aeration, managing water quality and adjusting feeding remain essential, but the response should not be identical for every rainfall event. By combining reliable measurements, shrimp feeding response, multiple environmental indicators and records from previous events, farm teams can progressively build a better understanding of their own ponds and make more informed decisions throughout the rainy season.

Area	Additional field practice	Why it adds value
Equipment readiness	Calibrate DO, pH, salinity and temperature meters before the rainy season.	Reliable measurements are essential when pond conditions change rapidly.
Biomass $\times$ aeration capacity	Review expected biomass against normal and emergency aeration capacity.	Readiness should reflect actual crop oxygen demand, not simply whether aerators are available.
Pre-rain baseline	Record DO, pH, salinity, alkalinity, temperature, bloom condition and feeding response before expected heavy rain.	Provides a reference for judging the magnitude of change rather than individual values in isolation.
Trend-based decisions	Evaluate direction and magnitude across multiple observations rather than reacting to one reading.	Supports proportionate responses and helps avoid unnecessary correction.
Multiple-sign approach	Increase management attention when several indicators change together, such as appetite, temperature and DO.	Reflects the cascade of environmental changes described in this article.
Health readiness	Review biosecurity, health monitoring and response procedures before the higher-risk period.	Links environmental preparedness with the seasonal farming-failure pattern observed in SyAqua's 2025 database.
Post-rain observation	Continue increased observation after rainfall even when visible conditions begin to improve.	Some pond and shrimp responses may continue after rainfall has stopped.
Farm learning	Record rainfall, pond response, management actions and subsequent crop response.	Builds farm-specific knowledge of how individual ponds respond to rainfall.
Next-event improvement	Review previous rainfall records when the next event is forecast.	Turns monitoring records into progressively better management decisions.

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Figure 3: SyAqua's Daily feed calculator

October 2021.

More references can be given on request.

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Eco-Friendly Aquaculture: Harnessing Agro-industrial Wastes for Feed and Water Quality Management

Hema Dhruw, Dushyant Kumar Damle*, Jham Lal, Rupesh Kumar, Rakesh Nirmalkar, Sai Prashad Bhusare, Manorama Chauhan

Late Shri Punaram Nishad College of Fisheries, Dau Shri Vasudev Chandrakar Kamdhenu Vishwavidyalaya, Durg, Chhattisgarh-491995, India

*Corresponding email: dushyant.damle@dsvckvdurg.ac.in (Dushyant Kumar Damle)

Abstract

Aquaculture has become an essential contributor to global food security, yet its rapid rise has highlighted problems linked to feed shortages, high production costs, environmental damage, and excessive dependence on chemicals and fishmeal. Agro-industrial wastes generated by crop milling, fruit and vegetable processing, sugar businesses, breweries, and oilseed extraction units offer a sustainable and cost-effective alternative for feed formulation and water quality management. Fish development, immunology, antioxidant capacity, and disease resistance are all improved by these wastes' beneficial nutrients and bioactive chemicals, which also lessen the need for antibiotics. Additionally, waste-

derived compounds like biochar, compost, and carbon-rich residues enhance the quality of pond water by lowering contaminants and promoting microbial balance. Useful applications show substantial economic benefits, such as rice bran in aquaculture, fruit peel extracts, and brewery leftover grain.

Keywords: Feed, Agro-industrial, Waste, Sustainable aquaculture.

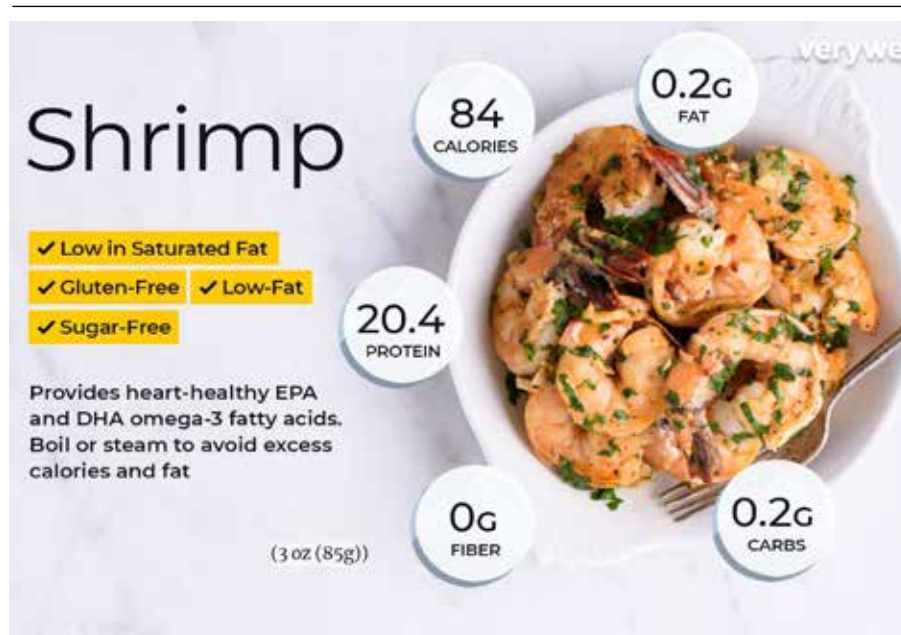
1. Introduction

Fish farming, often known as aquaculture, has grown to be a significant global source of seafood. Presently, fish is one of the best sources of protein, and as the world's population continues to rise, more economical and healthful food is needed. However, overfishing and climate change are causing wild fish

stocks to decrease. Aquaculture is now more crucial than ever because of this. However, as aquaculture expands, certain issues also arise. Inappropriate management of fish farming can, like, cause water pollution from surplus feed and garbage, harm mangroves and other natural areas, Overuse chemicals to manage illness, Demand for fishmeal is putting more strain on wild fish. These problems demonstrate the need for aquaculture to expand. India's total fish production hit a record 195 lakh tonnes in 2024–2025, a notable rise over previous years, with the majority of this gain coming from inland and aquaculture production. A review of data from 2024 (FAO, 2023-2024) shows aquaculture production has overtaken capture fisheries globally for the first time. The Food and Agriculture Organization (FAO) has identified sustainable growth as a major trend. While some species, like seabass and tilapia, saw production swings, others, like mud crab and pangasius, displayed strong expansion in India. The article focuses on how agro-industrial wastes can be beneficially used in aquaculture to reduce feed costs, boost growth, and maintain better pond water.

2. Understanding Agro-Industrial Wastes

Leftover materials produced during the production and processing of crops, cattle, fruits, and other food products are known as agro-industrial wastes. Despite being considered as waste, they contain useful nutrients that can be utilized



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again in aquaculture as probiotics, feed components, or water quality improvers. Agro-industrial wastes are generated from a wide range of agricultural and food-processing industries. Major contributors include crop milling industries such as rice mills and wheat mills, which produce residues like bran and husk. Fruit and vegetable processing factories also generate large quantities of peels, pulps, and seeds as by-products. Sugar mills produce waste such as molasses and bagasse, while breweries and distilleries generate spent grains and yeast sludge. Edible oil extraction industries contribute oilseed cakes and other residues, and dairy and milk product industries add whey and other milk-processing by-products to the waste stream. These industries collectively produce substantial amounts of nutrient-rich wastes that have high potential for value addition in aquaculture.

3. Utilization of Agro-Industrial Wastes as Aquafeed

The use of agro-industrial wastes as affordable and nutrient-rich components in aquaculture diets is growing. These wastes contain important proteins, carbohydrates, lipids, vitamins, minerals, and fibres. They are produced by industries like crop milling, fruit and vegetable processing, sugar mills, breweries, oil extraction, and dairy facilities. These by-products are added to fish and

shrimp meals, either directly or after processing, rather than being thrown away. Rice milling produces rice bran, polish, and broken grains commonly used as low-cost feed ingredients in Asian aquaculture. In India and Bangladesh, rice bran is a key component of carp grow-out diets and is also used in pond fertilization. It enhances natural productivity, reduces feed cost, and improves energy utilization (De Silva and Anderson, 1995). Brewery spent grain, a high-protein by-product of beer manufacturing, has been successfully used as a partial replacement for conventional feed ingredients like soybean meal and fish meal. Studies on carp and tilapia show that BSG can replace 20–40% of commercial feed without reducing growth performance. It also lowers feed cost and reduces industrial waste disposal issues (Olvera-Novoa *et al.*, 1990). Agro-processing industries (juice, pulp, and dehydrated fruit industries) generate large amounts of peel and pulp waste. Extracts from citrus peel, pomegranate peel, and papaya processing waste have been used in feeds for tilapia and carp to improve immunity, antioxidant status, and disease resistance (Abdel-Tawwab and Ahmad, 2009).

4. Role of Agro-Industrial Wastes in Water Quality Management

Certain agro-industrial wastes, such as those from textile mills and pulp

and paper mills, include dangerous pollutants that can contaminate land, water, and air (Gupta and Shukla 2020; Paritosh *et al.* 2017). It has been demonstrated that both organic and inorganic substances found in waste from the pulp and paper sector have detrimental impacts on aquatic ecosystems, including mutagenicity, carcinogenicity, and endocrine disruption (Servos 2020). Although agro-industrial waste often contains a lot of nutrients, if it is not handled, it might harbor dangerous faecal coliform bacteria, herbicide or pesticide residues, and pathogenic diseases (Ravindran *et al.* 2018). When such wastes are applied repeatedly without being treated, pesticide and herbicide residue accumulates in the soil, which can be detrimental to beneficial soil bacteria (Ramírez *et al.* 2019). Numerous regions have successfully implemented agro-industrial wastes in actual aquaculture systems. Crop leftovers and animal manure are utilized as natural fertilizers in integrated fish farming to increase plankton production, which continuously supplies fish with natural food while lowering feed costs. Brewery spent grain (BSG) has been shown to be a cost-effective source of protein for carp and tilapia diets, enhancing growth and feed conversion without compromising fish health. Large volumes of trash are produced by industrial and agricultural processes, but rather than considering these materials as worthless, we are now figuring out how to transform them into useful instruments for preserving the purity of water. Many agro-industrial wastes, such as rice husk, coconut shell, sugarcane bagasse, fruit peels, and food-processing leftovers, can be turned into biochar and compost. These natural by-products help eliminate dangerous pollutants such as heavy metals, pesticides, excess nutrients, colours, and organic compounds from water. By employing these waste products, we not only improve the quality of water but also reduce environmental pollution and trash disposal problems. This method shows how basic resources from farms and industry

Source of Agro-Industrial Waste	Example By-Products Used in Aquafeed	Nutritional / Functional Role in Feed
Crop Milling Industries	Rice bran, wheat bran, broken rice	Provides carbohydrates and fiber; improves digestion and energy supply
Fruit & Vegetable Processing	Mango kernel meal, banana peel, citrus pulp, tomato pomace	Supplies vitamins, antioxidants, fiber; supports growth and immunity
Sugar Industry	Molasses, press mud	Acts as a carbon source, promotes microbial protein (biofloc) production
Edible Oil Extraction Industries	Groundnut cake, soybean cake, sesame cake, sunflower cake	Rich in plant protein and essential fatty acids; supports body growth and metabolism

No. 1 Utilization of agro-industrial waste as an alternate fish feed.

may support better ecosystems by creating a sustainable cycle where trash is recycled, treatment becomes less expensive, and water bodies become cleaner.

5. Use of Bioactive Compounds from Agro-Industrial Waste in Aquaculture

Nearly half of all fish consumed globally are now produced by the expanding aquaculture sector, but its quick growth has presented new difficulties. Issues including poor water quality, unbalanced meals, and abrupt temperature and pH changes can readily affect fish reared in confined quarters. Antibiotics have historically been used to treat illnesses, but overuse of them is dangerous since it promotes bacteria that are resistant to them and is growing unpopular with customers. For this reason, researchers are exploring for safer options that naturally boost fish health. Utilizing bioactive substances made from agro-industrial waste is one possible strategy. These organic compounds can improve fish growth, strengthen immunity, lessen oxidative stress, and aid in disease resistance providing a sustainable and eco-friendly answer for contemporary aquaculture. Bioactive compounds from agro-industrial waste used in aquaculture include phenolic compounds (such as flavonoids, polyphenols, and proanthocyanidins), carotenoids (like astaxanthin), and polysaccharides. Other examples include organic acids, vitamins, and proteins and peptides, which can enhance fish health and immunity.

Conclusion

Utilizing agro-industrial wastes in aquaculture provides a viable and cost-effective way to address many of the industry's expanding problems. These nutrient-rich by-products from crop milling, fruit and vegetable processing, breweries, sugar factories, and oilseed industries serve as useful alternatives to conventional feed ingredients and chemical-based water treatment approaches. Their application helps reduce feed costs, promote natural productivity, and improve fish growth, immunity,

and overall health through natural bioactive substances. Additionally, by lowering contaminants and extra nutrients, waste-derived compounds like compost and biochar improve water quality management. Aquaculture systems reduce pollution and their reliance on fishmeal and antibiotics by turning waste into valuable inputs. All things considered, incorporating agro-industrial wastes into aquaculture is a workable, sustainable, and scientifically validated strategy that improves the aquaculture industry's long-term production, economic resilience, and environmental health.

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Artificial Intelligence for Aquamimicry for India: Towards Zero-Waste Aquaculture Systems for Shrimp and Fin fishes

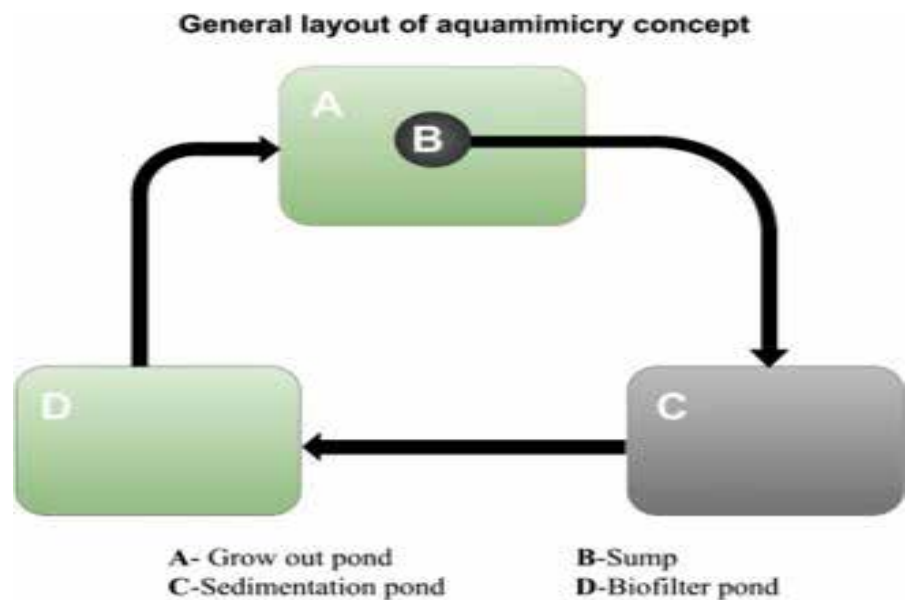
A.M. Raksha, G.K.Raswin Geoffery, S. Felix, St. Devasahyam Institute of Fisheries Science & Technology, Amanattantheri, Enayam Post, Kanniyakumari Dist – 629 193.

Highlights

- **Aquamimicry** is a sustainable shrimp farming technique that mimics natural aquatic ecosystems without harmful chemicals.
- It uses **probiotics, rice bran, and beneficial microbes** to promote natural food organisms like copepods.
- This approach improves **shrimp health, feed efficiency, disease resistance, and water quality**.
- Aquamimicry reduces environmental impacts while supporting **eco-friendly and profitable aquaculture**.
- It offers a promising solution for **sustainable large-scale and semi-intensive shrimp farming**.

Abstract:

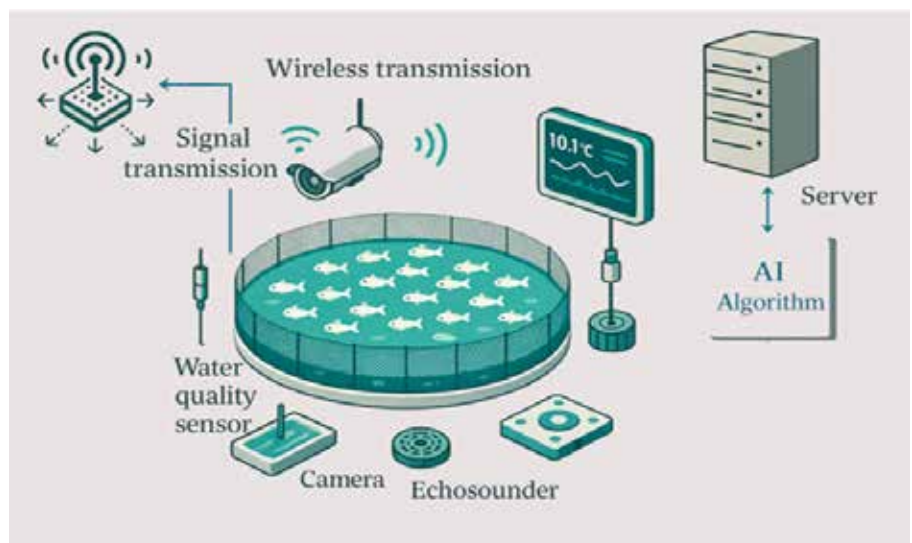
Aquaculture contributes significantly to foreign profits and is essential to the world's economy and food security. However, increased use of pesticides and water exchange in intensive operations, particularly in shrimp farming, has resulted in disease outbreaks and environmental issues. An environmentally benign solution to these problems is aquamimicry, which replicates natural aquatic ecosystems without the use of dangerous chemicals. This method, sometimes referred to as organic shrimp farming, makes use of resources and natural processes. The secret is to use microbial blooms created by carbon sources like rice bran and probiotics to promote zooplankton, especially copepods. increased stability, increased shrimp



health, improved feed conversion, disease avoidance, appropriateness for large-scale and semi-intensive operations, and higher nutritional quality are only a few advantages of aquamimicry.

Aquamimicry practices:

Fermented rice bran (FRB) is crucial, especially in Thailand, where aquamimicry-based shrimp farming has gained popularity. FRB is made



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using finely ground rice bran powder, water, probiotics, and hydrolyzing enzymes. It is then fermented for a whole day. In this procedure, rice bran acts as a prebiotic, and the probiotics added have a symbiotic effect that boosts microbial activity. In less than a week, applying 500–100 kg/ha of FRB results in a copepod bloom, ensuring that post-larvae (PL) have easy access to live feed before stocking without the need for dangerous pesticides. As a result, FRB is an extremely efficient and environmentally responsible production method. Ponds are routinely seeded with FRB, with the dose modified based on turbidity levels, to sustain copepod populations during the grow-out period. Lower concentrations of 10–20 people per square meter can be used to supply PL.

In comprehensive aquamimicry methods, water from grow-out ponds enters sedimentation ponds through a central drainage system. Here, species like catfish and milkfish are raised according to salt levels. These fish stimulate the growth of oligochaete worms, which are their natural food supply, by agitating detritus. Water from the sedimentation pond is moved into biofilter ponds where tilapia are cultivated in an effort to further decrease waste and improve water quality. Pumping the cleansed water back into the grow-out ponds creates a closed-loop system that lessens its impact on the environment. This integrated approach enables farmers diversify their revenue streams by increasing fish crop production while preserving shrimp output. By recycling nutrients and reducing chemical inputs, aquamimicry with FRB demonstrates how ecological ideas may be combined with aquaculture to produce shrimp that is inexpensive, environmentally benign, and sustainable.

Aquamimicry using IoT device:

The creation of aquamimicry, which uses IoT sensors to track shrimp growth and pond properties, is a new advance in aquaculture. By

combining the accuracy of digital technology with the natural principles of aquamimicry, farmers may have better control over feeding efficiency, sediment management, and water quality. To ensure that the pond environment is stable and healthy for shrimp, IoT sensors continuously monitor critical parameters including temperature, turbidity, pH, and dissolved oxygen. Growth rates and harvest times may be estimated with the use of predictive analytics, and farmers can respond quickly to deviations thanks to automated warnings. Sediment buildup is a major issue in aquamimicry that may be managed with the use of intelligent monitoring systems that start automated discharge mechanisms before circumstances become dangerous.

Additionally, feeding behavior may be monitored by IoT cameras, enabling more effective feed scheduling and waste minimization. Cloud-based dashboards and mobile applications allow farmers to remotely access real-time data, which enhances decision-making and reduces the need for manual labor. This combination of IoT with aquamimicry not only enhances sustainability but also makes scaling up to larger ponds more feasible since distributed sensor networks can cover large areas and detect minute differences in water quality.

Ultimately, the integration of IoT and aquamimicry results in a precision aquaculture model that lowers costs, improves shrimp quality, and ensures traceability for global markets. As consumer demand for ecologically friendly seafood rises, this approach—which blends natural biological processes with state-of-the-art IoT monitoring to support farmers and future generations in aquaculture—may become the new standard in shrimp farming.

Zooplankton diversity:

Maintaining natural feed and water quality in a culturable pond is crucial for effective farm management in the aquaculture sector. About 47% of Catlacatla's sustenance comes from zooplankton, compared to 23% from shrimp. By maintaining a balance between O₂ and CO₂, maintaining appropriate oxygen levels, and increasing the amount of organic materials deposited in ponds, their population demonstrates or influences the cultural system. This balance affects a number of factors, including controlling pH, stopping the growth of microalgae and pests, and maintaining water temperature.

In aquamimicry, the production system resembles natural estuary waters and includes the beneficial zooplanktons and microalgae that are created in the water. Since the rice bran itself nourishes the



Pond setup for aquamimicry practicing



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Shrimp ponds management through aquamimicry practices

zooplanktons and the bacteria present are in charge of producing pre-and probiotics that create a healthy environment, the system does not require the use of any chemicals or antibiotics. The survival and development rate of farmed fish are also influenced by the quantity and variety of plankton.

Shrimp farming by aquamimicry:

The best source of identified carbon in the aquamimicry system is rice bran, which is fermented by microorganisms. Rice bran powder may be fermented for 24 hours by adding water, probiotics, and hydrolyzing enzymes. In this case, rice bran functions as a prebiotic and adds probiotic microorganisms to provide a symbiotic effect. Aquamimicry systems can incorporate 500–1000 kg ha⁻¹ of fermented rice bran. The feeding of live items, particularly copepods, is seen after a week. Copepods develop at an appropriate density in the culture pond before shrimp PL stocking. Next, a density of 10 to 20 organisms/m⁻² is used to stock shrimp PL.

In order to sustain zooplankton blooms and the production of oocules, a daily dose of fermented rice bran (typically 1.0 ml L⁻¹) is regularly supplied to the ponds during the rearing phase. The proper addition of FRB in an aquamimicry system depends on the water's turbidity level. Fermented soybean meal will subsequently be used for feeding, which will save feed expenses.

By producing low molecular weight

peptides, increasing the bioavailability of minerals, and lowering its ANF, fermentation of soybean meal (SBM) can improve its nutritional value and digestibility. Furthermore, fermented SBM has around 10% more protein than SBM, although its essential amino acid composition has little changed. Furthermore, fermented SBM has probiotic qualities and can boost the effectiveness of aquafeeds by increasing the activity of trypsin and brinolytic enzymes.

Case studies:

A successful aquamimicry project was finished in the Philippines. The study placed a strong emphasis on using natural feeds in shrimp ponds. In the cultivation ponds, rice bran was utilized as an additional feed. According to their research, the profitability of the aquamimicry and traditional aquaculture systems was 40% and 17%, respectively.

Farmers in the Indian state of Andhra Pradesh have successfully used the aquamimicry system for shrimp farming; they manage pre-stocking well, stock at 40 PL m⁻², and provide regular aeration; supplementary feeding is provided at a low cost by using fermented rice bran (carbon source) to produce zoo-plankton; appropriate probiotics (5.0 to 10 ml L⁻¹) are added to maintain water quality and plankton density; and sludge that has accumulated on the rearing pond's floor at regular intervals.

With a 94% survival rate and a total production of 5.53 tons at the conclusion of the culture period, the cost of production per kilogram of shrimp in the aquamimicry system is around 65% lower than in the conventional system. Furthermore, it has been observed that the aquamimicry system's water quality and shrimp health are superior to those of traditional shrimp farming.

Pros:

- By using this technique, parameters will be at their ideal level and there will be no fluctuations in the water quality.
- Enhancement of the shrimp's total nutrition when they consume FRB and copepods produced by its addition.
- There is also less development of black soil. Adoption of this technology can help lower the cost of production.



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- Since no circumstances that are conducive to the growth of harmful organisms are encouraged, the cultured organism is raised in a stress-free environment.
- Regularly declining, resulting in frequent diseases Shrimp thrive well in a pond that replicates the natural estuary conditions.
- Reduce the ratio of food conversion Cutting down on water exchanges

Cons:

- Applying this idea to indoor culture techniques is challenging.
- Utilizing a rather large treatment pond Possibility of a new pathogen emerging

Conclusion:

Shrimp aquaculture that uses aquamimicry is more sustainable than traditional farming. The inputs used in manufacturing do not harm people or shrimp. The aquamimicry concept does not make use of dangerous chemicals or antibiotics. Production expenses can be reduced by employing this method. These advantages make aquamimicry viable from an economic and environmental standpoint. The creative concept of aquamimicry effectively provides the shrimp farming industry with a long-term rival. It is a branch of aquatic technology that works together to mimic the features of aquatic habitats in order to produce living food creatures for fish or shrimp. By integrating IoT devices with aquamimicry processes, shrimp farming might become more sustainable. IoT technologies provide real-time monitoring of water quality, sediment levels, and feeding activity, ensuring that pond conditions remain optimal for shrimp development. Automated alerts and predictive analytics reduce risks, boost output, and save manufacturing expenses. This combination of digital precision and ecological imitation makes it easier to scale aquamimicry to larger ponds. It also enhances sustainability by lowering resource waste and chemical inputs. IoT-enabled

aquamimicry may ultimately set a new benchmark for innovation in shrimp farming, ensuring healthier shrimp, increased profitability, and long-term benefits for aquaculture's future generations.

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Scatophagus argus – less regarded as brackishwater foodfish and more as aquarium fish

Subrato Ghosh, Kalighat, Kolkata – 700026, West Bengal, Email: subratoffa@gmail.com

Highlight points

The brackishwater fish *Scatophagus argus* prefers habitats like estuaries and mangrove forest water bodies in West Bengal. It can be maintained both in freshwater and marine aquarium, behaves calmly. It has unique appearance, with presence of many leopard-like round blackish-brown dots/spots on body surface on mainly upper half on both sides laterally. Juvenile/fingerling stage *S. argus* is an economically-important ornamental fish, much desired by hobbyists and in demand. It accepts both plant and animal food matter (boiled lettuce, soaked oatmeal porridge, aquarium plant *Nitella* sp, algae, water flea *Daphnia* sp, small worms) when kept in aquarium. A demerit of this fish is that it inflicts severe pain when any one of its strong spinous rays of dorsal fin or anal fin pierce into palm of an inexperienced careless fish catcher or farm worker.

Preference as aquarium fish

The *Scatophagus argus*, commonly known by the name ‘spotted scat’, is a commercially-important brackishwater fish in West Bengal found in the coastal waters, in marine zone of Hooghly estuary in lower West Bengal from Diamond Harbour to Bakkhali, in lower portion of tidal rivers, in large brackishwater impoundments or ‘gher/bheri’ connected to estuaries and in seven other estuaries of rivers of Indian Sundarbans. It is popularly sold as ‘Indian discus’ in aquarium fish markets of India. Particularly at smaller sizes with attracting rounded body, *S. argus* has heavy demand as an aquarium (ornamental) fish throughout the world, behaves peacefully in aquarium conditions, compatible with other species. A



Adult spotted scat 150gm at GFTS farm

brackishwater fish by nature, *S. argus* can easily adapt to freshwater aquarium conditions. As mentioned by Dr Babita Mandal and seven other authors in their article published in Vol. 30 (1) issue of Aquaculture Asia magazine (January-March 2026), many fish seed collectors in Indian Sundarbans region near Bay of Bengal capture juvenile stages of various ornamental fish which can tolerate wide range of salinity levels – it includes *S. argus*, one amongst total six ornamental fish species, for livelihood generation. *S. argus* is known for its unique colour and adaptability. Juveniles are either reared in nursery ponds for a short duration or directly sold to ornamental fish traders in Kolkata city.

Dr Md. Hashmi Sakib and seven other authors in their article published in Vol. 10 (14) (30th July, 2024) of Heliyon-Cell Press have mentioned that in aquarium fish markets, *S. argus* of Sundarbans region is highly sought after and commands a competitive price. In the article published in Vol. 4 (6) of World

Journal of Fish and Marine Sciences (Year 2012), Dr Banani Mandal and three other authors have mentioned *S. argus* as the first species in the list of sixty-seven species of ornamental finfish they have identified in Sundarbans mangrove water bodies, which were sampled from tidal estuarine creeks of Muriganga, Hatania-Doania, Saptamukhi, Thakuran and Matla rivers.

Farming in small ponds

Early stages of wild-collected *S. argus* survive and exhibit good growth in low-saline brackishwater ponds (8-12ppt). Present author Subrato Ghosh has further mentioned in his article published in Vol. 22 (3) of Aquaculture Asia (July-September 2018) that few brackishwater fish farmers in coastal Blocks in South 24 Parganas district of West Bengal have endeavoured to produce juveniles/advanced juveniles of *S. argus* (30-48 mm size) for aquarium (ornamental) purposes. It can fetch Rs 10/- - 20/- per piece in retail markets and higher prices in international markets. The Joykrishna hatchery and fish seed farm owned by Sri Tapan Maity, located in Kakdwip



Sub-adult spotted scat at GFTS farm

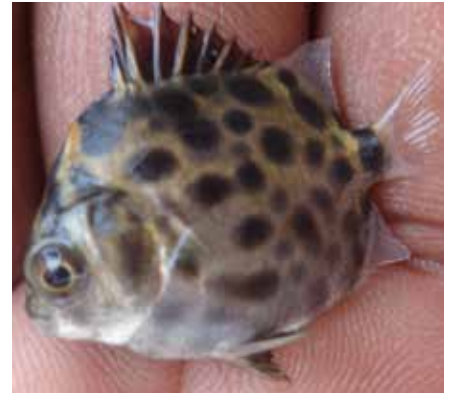
Block on eastern bank of down estuarine zone of Hooghly River is a unique site in West Bengal where juveniles and sub-adults of *S. argus* are produced in brackishwater ponds for commercial utilisation as aquarium fishes. Every week, 2000-2500 nos of *S. argus* juveniles 'one rupee coin' in size in local parlance, are sold by Sri Maity to selected aquarium fish traders in Howrah District. The bigger 45-48mm stage, popular locally as 'nontaa (salty) snack biscuit' size, is also raised in ponds of this hatchery for sale.

Dr Babita Mandal and other authors in their article have also underscored the achievements of Sri Tapan Maity and other few farmers about brackishwater ornamental fishes having commercial value, *S. argus* and five other fishes, which are produced at their farms. According to the authors, Sri Maity collects juveniles of

S. argus and other fishes from nearby tidal waters and grows them for selling to the ornamental fish trade. He purchases *S. argus* juveniles from fish seed collectors in Sundarbans, rears in nursery ponds for 2-3 months until they attain marketable size of 5.0-9.5cm. All six brackishwater ornamental fishes are in high demand in ornamental fish market. These farmers have shown potential and prospect of entrepreneurship development and rural livelihood opportunities through brackishwater ornamental fish farming in Indian Sundarbans region. *S. argus* obtained from marine capture fishery may attain 500-600gm body weight.

As foodfish in villages of southern West Bengal

S. argus is known by the Bengali names 'Payratoli', 'Payrachanda' and 'Kunkuni' in West Bengal. It is very less preferred as foodfish in Kolkata city and suburban areas, but quite relished in villages of South 24 Parganas, North 24 Parganas and Purba Medinipur districts of this state. It is very good in taste. It is normally not found in city fish markets, most people are unfamiliar about this fish, considered as a foodfish having low economic importance. But elderly men and women in nearby and distant (far away) villages consider it as nutritious, low in fat content, beneficial for human health and very good in



Close view of a spotted scat juvenile

taste – also has less intramuscular spines. Elderly village men and women buy *S. argus* from local small-scale fish markets (50-100gm in size) or collect from brackishwater pisciculture impoundments ('gher'), brackishwater wetlands and narrow creeks during low tide, 80-200gm in size (weight). At home before cooking, cutting off (using the traditional curved cutting heavy iron blade positioned erect at 1.0-1.5 feet in height) the 11 hard (strong) spinous rays of first dorsal fin and 6 hard spinous rays of anal fin of this fish is not at all easy for the women. Further the body scales are very small, has to be repeatedly washed to eliminate it after scrapping with stainless steel knife. According to the women, the hard spinous rays of dorsal fin of *S. argus* are even harder than those of *Anabas testudineus*. The fish has compressed body much like pomfret *Pampus argenteus* and Pacu/ Rupchanda *Piaractus brachypomus*.

The women prepare mainly five kinds of dishes using transversely cut pieces of *S. argus* and main ingredients: 1) Thick curry of *S. argus* with poppy seed paste, mustard seed; 2) Thick curry of *S. argus* with ginger paste, garlic paste, onion, tomato, red chilli powder; 3) Light curry of *S. argus* with pieces of taro or taro root, cumin seed, coriander seed, green chilli, potato; 4) Light curry of *S. argus* with ripe tamarind; 5) Light curry of *S. argus* with mustard seed, brinjal, potato, sundried black gram lentil dumplings, green peas.

Unwanted in brackishwater farm ponds during netting operation

At four medium-size to large



Large sized spotted scat 75-80gm at Joykrishna hatchery



Few small-sized spotted scat

brackishwater fish ponds of Government Fish Technological Station (GFTS), Junput, Purba Medinipur under West Bengal Fisheries Department, located 400-500mts landwards from Bay of Bengal, *S. argus* is considered as unwanted. Sea water enters into these ponds during high tide via sluice gate, and along with it enters the seeds of brackishwater fishes including *S. argus*. It grows mostly naturally, but weed clearance and supplementary fish feeding is done quite regularly in these ponds. While harvesting marketable-sized *Liza parsia*, *Liza tade*, *Mystus gulio*, *Megalops* sp, *Terapon jarbua*, *Oreochromis niloticus* *Lates calcarifer* from these ponds in morning hours for sending to fish auction market, considerable numbers of small-sized *S. argus* gets entangled individually in the square meshes of the net here and there. One has to be very careful while holding the small-sized, medium-sized and adults of *S. argus* in live condition in palms. *S. argus* can inflict wound and terrible pain on palms and fingers when any one of its hard spinous fin rays pierce into the skin of the person's finger accidentally. It happens when the person (or persons) is hauling the net from water column part by part and unknowingly his right or left palm falls on the body of the entangled fish.

While bringing out the manually-operated drag net along with the above-mentioned economically-important brackishwater foodfishes from ponds, hard spinous fin rays also pierce into the skin of feet sole of farm workers (farm labours) when they step over in the underwater part of drag net unknowingly in marginal areas of ponds. *S. argus* 25-40gm in size is completely unwanted as it causes trouble to workers in the brackishwater fish ponds of our GFTS. It is difficult to remove it out from the meshes of nets. Individual spinous fin rays of 1st dorsal fin of *S. argus* remain wide open and erect when alive - ready to give a poisonous sting into human skin and inflict unbearable pain, like that of the pectoral fin spine of *Heteropneustes fossilis*. At the end of netting operation and days' work, those small-sized *S. argus*, already dead, are taken by one or two farm workers for eating at home with family members. It may attain 80-200gm body weight in one year in ponds or 'gher'. Those 50-100gm in size may fetch a price of Rs 100-120 per kg to fish sellers in village fish markets but those further small-sized ones are not sold in markets and considered economically-unimportant.

End note

Dr Gouranga Biswas and six other authors in their article published in Vol. 34 (1) of Journal of Indian Society of Coastal Agricultural Research (Year 2016) have mentioned that there has been a recent trend among the fish farmers to produce *S. argus* fingerlings (40-50mm size) for ornamental purposes. Wild-collected *S. argus* fry when stocked at 0.33gm body weight in 1000lit FRP tanks @ 100nos per cubic metre

water had obtained a final body weight of 4.11gm individually (length 49.16mm) with 96% survivability in eight weeks of rearing in low saline 12ppt brackishwater. This stage will fetch good price in ornamental fish market. This stocking density gave the highest growth and survival of *S. argus*. This study was aimed to establish a rearing protocol of *S. argus* fry till fingerling (saleable) stage. There had been nearly similar body weight (size) obtained when *S. argus* fry were reared in '200nos per cubic metre' stocking density, and it was considered as most profitable on the part of brackishwater ornamental fish farmers.

As pointed out by Late Dr Amitabha Ghosh in his Book 'Fishes of Hooghly Estuary' (ICAR-CIFRI, Barrackpore publication), *S. argus* contributes a minor part of capture fishery in the lower part of Hooghly estuary. *S. argus* farmers, as brackishwater aquarium fish producers, depend upon and purchase early stages and early juveniles of the fish from professional brackishwater fish seed collectors who operate (work) in estuaries and tidal rivers. But Scientists at Finfish Culture Division of ICAR-Central Institute of Brackishwater Aquaculture, Chennai have achieved a breakthrough and have standardized the process (methods) of induced breeding, hatchery practices and healthy seed production of *S. argus* in captive conditions via stripping method. A News on it appeared in The Hindu, dated October 18, 2016, Chennai Edition. It will be an alternative to availability and collection of *S. argus* seeds from nature and brackishwater fish farmers will be benefitted.



Spotted scat juveniles 25-30mm at Joykrishna hatchery

SafMannan

Predictable performance



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