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August 2026

Annual Subscription: ₹800 Foreign USD 100

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Black Soldier Fly Larvae: Fuelling the Future of Circular Aquaculture in India

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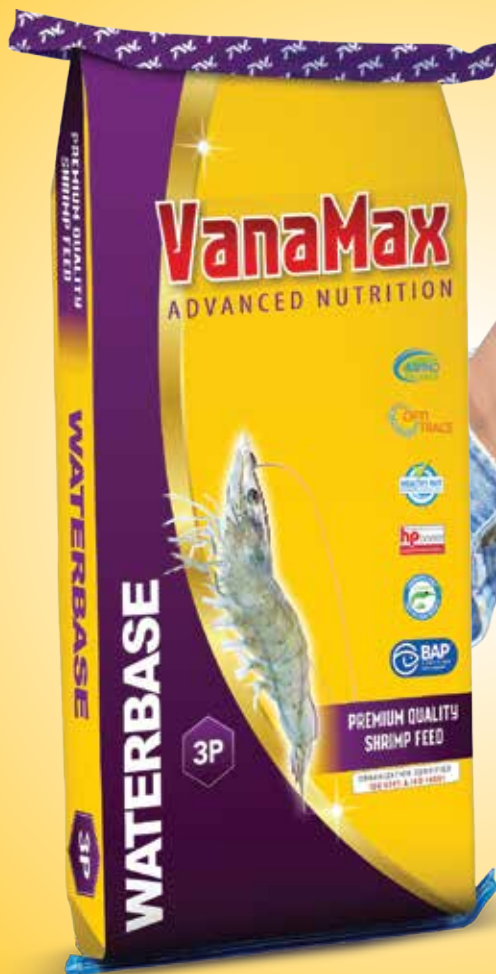
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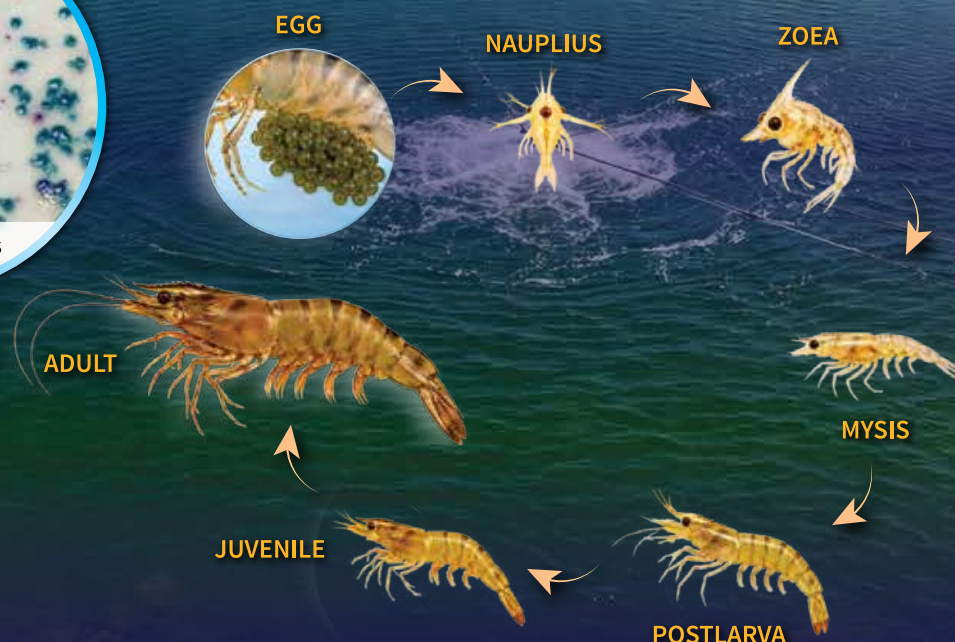
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Aqua International

English Monthly Magazine
(Established in May 1993)

Volume 34 Number 4 August 2026

Editor & Publisher

M. A. Nazeer

Editorial & Business Office:

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Website: www.aquainternational.com

Annual Subscription

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

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

Edited, printed, published and owned by M. A. Nazeer and published from BG-4, Venkataramana Apts., 11-4-634, A.C.Guards, Hyderabad - 500 004, India. Printed at Srinivasa Lithographics.
Registered with Registrar of Newspapers for India with Regn. No. 52899/93. Postal Regn. No. L II/RNP/HD/1068/2021-2023.
Views and opinions expressed in the technical and non-technical articles/ news are of the authors and not of Aqua International. Hence, we cannot accept any liability for any loss or damage arising from the use of the information / matter contained in this magazine.

- Editor



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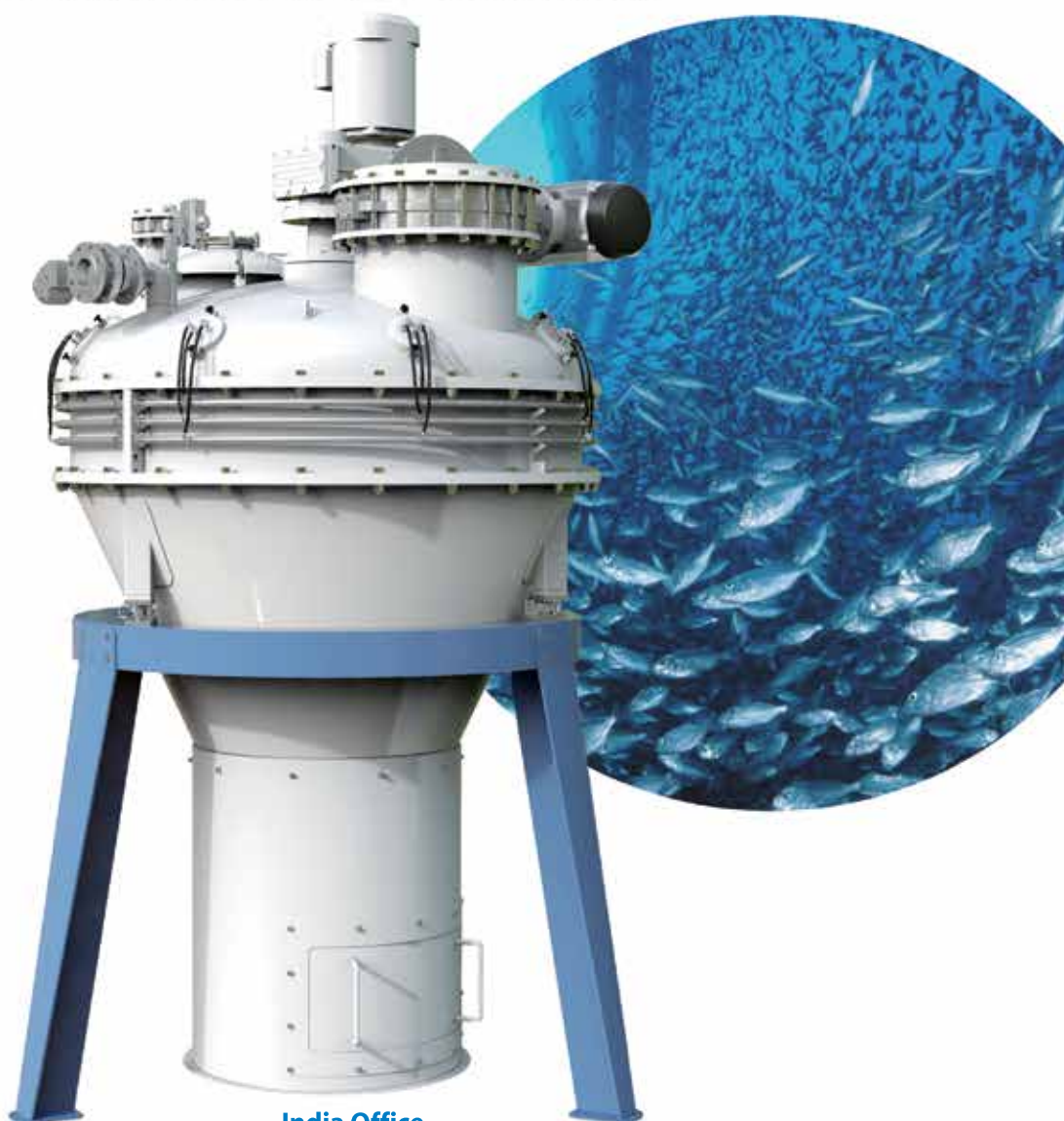
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Centre releases Rs 2,209 crore to states for big push to fisheries sector

BSFL packs up to 73.35% crude protein, completely replacing costly fishmeal while supercharging fish immunity, growth, and survival. Ultimately, this BSFL cultivation loop creates a flawless circular economy that transforms regional bio-waste into highly valuable, omega-3-enriched feed and nutrient-rich organic frass fertilizer for the local plantation sector..



Dear Readers,

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

The real crisis in India's fisheries-

The Government of India, citing CMFRI data, claimed that 91.1% of 135 evaluated fish stocks were "sustainable" in 2022, projecting India's marine fisheries as a global success story. However, this optimistic picture contrasts sharply with FAO's assessment, which describes Indian marine fisheries as having plateaued due to overcapacity, and with decades of fisher testimony reporting declining catches and vanishing species. This continental shelf is broadest in Gujarat and a part of Maharashtra, but remains quite narrow along the rest of the sub-continent. These waters provide favourable ecological conditions for commercially valuable species such as shrimp to feed, breed and grow. The construction of dams on rivers and destruction of mangroves impact the inshore fishing more than it impacts the distant waters. India's marine fisheries policy suffers from a data credibility gap and a governance vacuum in the most ecologically productive inshore zone. Genuine sustainability requires moving beyond output centric optics toward science based stock assessment, inshore ecosystem restoration, and inclusive fisheries governance that balances livelihoods with ecological limits.

Centre releases Rs 2,208.74 crore to states for big push to fisheries sector. The Department of Fisheries has released Rs 2,209 crore to the states, during the last three financial years from 2023-2024 to 2025-2026 under the flagship scheme of the Pradhan Mantri Matsya Sampada Yojana

(PMMSY) for holistic development of fisheries and aquaculture sector in the country, the Parliament was informed on 22 July 2026. India's fish production has jumped by 40 per cent from 142 lakh tonne in 2019-2020 to 198 lakh tonne in 2024-25 while fisheries exports have surged by 59 per cent from Rs 46,666 crore in 2019-2020 to Rs 73,890 crore in 2025-2026, reflecting the success of the blue revolution, Fisheries, Animal Husbandry and Dairying Minister Rajiv Ranjan Singh said in response to a question in the Rajya Sabha.

Single-cell protein replaces 50% of fishmeal in seabream diets. A study shows the potential of bacterial single-cell protein in a key Mediterranean species and provides new data on digestibility, gut health and disease resistance. As the aquafeed industry continues to diversify its ingredient portfolio beyond fishmeal and fish oil, alternative protein sources such as single-cell proteins have emerged as promising solutions. Among them, bacterial single-cell proteins (BSCPs) have demonstrated nutritional benefits in salmonids and shrimp. A recent study evaluated the digestibility and nutritional value of BSCP produced from methane-oxidizing bacteria as an alternative protein source for gilthead seabream (*Sparus aurata*). The BSCP ingredient, Uniprotein, supplied by Unibio, was evaluated in five experimental diets in which fishmeal was replaced at graded levels of 25%, 50%, 75%, and 100%, with a fishmeal-based diet serving as the control.

Khyber Group launches India's largest RAS-based Himalayan Trout Farming Facility Jammu & Kashmir's leading business conglomerate, the Khyber Group, has launched Khyber Aquaculture. India's largest, fully integrated, sustainable Recirculating Aquaculture System (RAS) based



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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.

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

Contd on next page

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Himalayan trout farming facility in Kashmir, aimed at transforming the region's trout industry into an integrated, export-oriented ecosystem by linking advanced aquaculture technology with local farming communities. The company integrates scientific farming practices, modern infrastructure, and environmental stewardship to deliver premium-quality aquaculture products for domestic and international markets.

In a riveting contest for the top spot, P Surya Bhaskar, who works with Devi Fisheries Ltd at Kakinada in Andhra Pradesh, was adjudged the winner of the second edition of National Skill Olympiad on Seafood Value Addition, with the grand finale held during Seafood Expo Bharat 2026 here. A total of ten trained seafood processing professionals showed their culinary competency and technical expertise in preparing seafood in the final round of the Olympiad on July 2, an initiative of the Marine Products Export Development Authority (MPEDA). Muthu Kumaran, of Theva & Co, Tuticorin, Tamil Nadu, grabbed the second spot while Ms Sagarika Sardar, who is associated with SS Seafoods Pvt Ltd, Kolkata, West Bengal and Ms Barasarani Jena, Sabri Food Products Pvt Ltd, Bhubaneswar, Odisha, came third and fourth, respectively. The winner of the final round was awarded Rs 100,000 while the prize money was Rs 75,000 for second and Rs 50,000 for third place, respectively. An amount of Rs 25,000 was given as a consolation prize for the fourth position.

Dr Foluke Areola, World Aquaculture Society President, Nigerian fisheries and aquaculture expert has now officially assumed office as the President of the World Aquaculture Society (WAS). She formerly took charge on 2 June 2026 on the sidelines of the World Aquaculture 2026, Singapore.

Mr K. Srinivasa Reddy, M.Tech from Andhra University and Founder & Managing Partner, Sri Varun Aqua Enterprises entered aquaculture industry in 1993 as a shrimp farmer. Drawing on over three decades of hands-on experience, he founded Sri Varun Aqua Enterprises in 2004 with the vision of providing farmers with quality products, reliable technical guidance, and dependable service. Despite becoming a successful entrepreneur, he continues to consider himself a farmer first and an entrepreneur next. This philosophy has shaped the company's farmer-first approach, where the success of farmers always takes precedence. His son Mr K. Sumant Reddy, joined the family business in 2021 and taking active role in the company. The company is engaged in shrimp farming, shrimp feed distribution, aquaculture healthcare products, shrimp procurement and trading, and technical advisory services. By combining scientific farming practices with quality products and personalized field support, Sri Varun Aqua Enterprises has built long-standing relationship with shrimp farmers across East Godavari and the surrounding coastal regions. Sri Varun Aqua Enterprises are the authorized dealers for Avanti Feeds, CPF India, and iFeed, offering farmers access to some of the most trusted shrimp feed brands in the country. Sri Varun Aqua Enterprises aims to further strengthen its position as one of Andhra Pradesh's leading aquaculture solutions.

In the Articles section, **Black Soldier Fly Larvae: Fuelling the Future of Circular Aquaculture in India** authored by Ashby GS, Jenisha Mol JG, Raswin Geoffrey, S. Felix discussed that

BSFL packs up to 73.35% crude protein, completely replacing costly fishmeal while supercharging fish immunity, growth, and survival. Furthermore, BSFL bioconversion drastically minimizes environmental impact, cutting feed-associated carbon emissions by 30% and slashing greenhouse gases 47 times more effectively than standard composting. Capitalizing on these eco-friendly benefits, India is uniquely positioned to establish a low-cost production model by upcycling abundant, free local resources like coconut poonac, tropical fruits, and coastal marine discards into premium BSFL aquafeed. Ultimately, this BSFL cultivation loop creates a flawless circular economy that transforms regional bio-waste into highly valuable, omega-3-enriched feed and nutrient-rich organic frass fertilizer for the local plantation sector.

Another article titled, **Some thoughts on low-cost major carp culture involving low-cost inputs** authored by Subrato Ghosh discussed on few possible aspects of low-cost major carp culture activity appropriate to conditions of resource-poor fish farmers residing in far-away villages. Their contribution to our country's annual fish production cannot be underestimated. Many of these farmers sell a major portion of the harvested table-sized fishes in markets, rest is consumed at home with family members after cooking. Even protection of environment of large water bodies (as in 'East Kolkata Wetlands' and others) is secured via fish culture practice. Small and marginal fish farmers must be advocated to take up scientific freshwater aquaculture. They hold small- to medium-sized pisciculture ponds, and contribute a considerable part (amount) of the country's freshwater fish production every year, wrt to the Indian major carps.

Another article titled, **Unlocking the Power of Kelp Forests: Exploring their Role in Blue Carbon** authored by Soumiya S and Surya K says that Kelp forests are crucial underwater ecosystems that play a significant role in absorbing carbon dioxide, supporting biodiversity, and protecting coastlines. As part of the blue carbon system, their rapid growth enables them to capture large amounts of carbon, making them valuable in climate change mitigation. These ecosystems not only act as natural carbon sinks but also help reduce coastal erosion and sustain fisheries and industries. However, they face growing threats from overfishing, pollution, marine heatwaves, and invasive species like sea urchins, leading to significant declines in kelp coverage. To counter these challenges, restoration efforts such as kelp reforestation, sustainable fisheries management, and integrating kelp into carbon credit markets are being implemented. Preserving and restoring kelp forests is essential not only for climate action but also for maintaining ocean health, supporting coastal economies, and ensuring a sustainable future.

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

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Khyber Group launches India's largest RAS-based Himalayan Trout Farming Facility

Khyber Aquaculture to reach maximum capacity of 7000 metric tonnes for year-long trout production

Introduces new standards for fish health; To support over 1000 local farmers; Platform for trout farming with data-driven systems and localised adaptation.



Versatile-Curry-Cut

Srinagar, India, 02

July 2026: Jammu & Kashmir's leading business conglomerate, the Khyber Group, has launched Khyber Aquaculture. India's largest, fully integrated, sustainable Recirculating Aquaculture System (RAS) based Himalayan trout farming facility in Kashmir, aimed at transforming the region's trout industry into an integrated, export-oriented ecosystem by linking advanced aquaculture technology with local farming communities.

Located on the banks of the River Sindh in Akhal, Kangan, in the Ganderbal district of Kashmir. Khyber Aquaculture is spread over 8 acres and has been built with an investment of over ₹100 crore. It is a technology-driven trout farming model designed to reuse & recycle water,

allowing year-round trout production in a climate-controlled environment. Khyber Aquaculture, currently with a 1500 metric ton capacity, will reach an annual production capacity of 7000 metric tons within 3 to 5 years. The hatchery of the unit is capable of producing up to 20 million fingerlings annually.

Mr Umar Tramboo, CMD, Khyber Aquaculture, "Our

technologically superior facility is an expansion of cold-water aquaculture in Jammu and Kashmir. Our cluster model is designed to integrate production, hatcheries, processing and supply chains while supporting more than 300 local farmers under the Holistic Agriculture Development Programme (HADP), through modern aquaculture systems and market access"

With in-house production, processing and packaging units, the initiative is expected to support more than 3,000 indirect livelihood opportunities across the region.

Khyber Aquaculture combines modern aquaculture technology with local environmental conditions and clean

production methods that contribute to climate-resilient fish farming in Jammu & Kashmir.

"It has taken us over 5 years to be completely ready. But the wait was worth it. With this launch, we plan to revolutionise India's aquaculture sector, introducing new standards for fish health and operational control. We want to be known as a platform for scaling trout farming with data-driven systems and localised adaptation," further continued Mr Tramboo.

Khyber Aquaculture uses American and Danish - bred eyed ova (eggs) along with Danish, French and German precision-controlled systems designed to increase survival rates by 25–30%, lower feed conversion ratios (FCR), and reduce pathogen exposure. It has been designed specifically for international quality and export standards. The fully vertically integrated operation utilizes hyper-hygienic cleaning lines and Modified Atmosphere Packaging (MAP) to achieve a 10-day chilled shelf-life and a 6-month frozen shelf-life making



Facade



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both Fresh/Chilled & Frozen stocks readily available from FY Q3 2026.

The unit's precision chilling systems maintain an exact 10-14°C water temperature.

Continuous injection maintains high dissolved oxygen levels (8-12 mg/L) required by trout.

The company has adopted a comprehensive sustainability framework encompassing water recirculation, biosecurity management, responsible feed practices, waste management, and environmental monitoring. Through RAS technology, the facility significantly reduces freshwater requirements while ensuring optimal fish health and production efficiency.

As global demand for premium, traceable, and sustainably farmed seafood continues to rise, Khyber Aquaculture plans to develop strong domestic and export market linkages, leveraging the



Artboard 5

unique geographical and environmental advantages of the Kashmir Valley.

The Khyber Aquaculture processing facility blends Himalayan Glacial water with Danish, French, and Swedish technology, featuring IoT-enabled, zero-waste farming and advanced cold-chain infrastructure.

The India trout market size reached 4,698.7 Tons in 2025. IMARC Group expects the market to reach 7,964.7 Tons by 2034,



C2



Artboard 2

exhibiting a growth rate (CAGR) of 5.86% during 2026-2034. The increasing consumer awareness of its high protein content, omega-3 fatty acids, rising consumption among individuals, and government initiatives promoting aquaculture activities to enhance the local economy represent some of the key factors driving the Indian trout market share.

About Khyber Aquaculture

Khyber Aquaculture is a leading player in cold-water fisheries business. Founded in 2022, Khyber

About the Khyber Group

The Khyber Group is Jammu & Kashmir's leading business conglomerate with interests spanning luxury hospitality, cement, real estate, healthcare and sustainable aquaculture. Established over 50 years ago in the heart of the Kashmir Valley, the group is known for its commitment to regional economic development. The group has consistently invested in ventures that create long-term value, that generate employment, and contribute to the socio-economic advancement of the region.



P Surya Bhaskar of Andhra Pradesh declared winner of second edition of National Skill Olympiad on Seafood Value Addition

Chennai, July 2: In a riveting contest for the top spot, P Surya Bhaskar, who works with Devi Fisheries Ltd at Kakinada in Andhra Pradesh, was adjudged the winner of the second edition of National Skill Olympiad on Seafood Value Addition, with the grand finale held during Seafood Expo Bharat 2026 here.

A total of ten trained seafood processing professionals showed their culinary competency and technical expertise in preparing seafood in the final round of the Olympiad on Wednesday, an initiative of the Marine Products Export Development Authority (MPEDA).

Muthu Kumaran, of Theva & Co, Tuticorin, Tamil Nadu, grabbed the second spot while Ms Sagarika Sardar, who is associated with SS Seafoods Pvt Ltd, Kolkata, West Bengal and Ms Barasarani Jena, Sabri Food Products Pvt Ltd, Bhubaneswar, Odisha,



came third and fourth, respectively.

The winner of the final round was awarded Rs 1,00,000 while the prize money was Rs 75,000 for second and Rs 50,000 for

third place, respectively. An amount of Rs 25,000 was given as a consolation prize for the fourth position.

MPEDA Chairman Shri P. Jawahar; Director Dr Ram Mohan M.K.; Secretary Dr

Gibin Kumar; Joint Director Shri Anilkumar; and Dr K N Raghavan, CEO, Seafood Exporters Association of India (SEAI), who was the Chief Guest, distributed cash prizes, medals and certificates to the winners.

At the Grand Finale, the finalists were tasked to prepare six value-added seafood delicacies having demand in the international markets — Nobashi Shrimp, Breaded Butterfly Shrimp, Cooked Peeled Deveined Tail-On (PDTO) Shrimp, Marinated Shrimp Skewers, Breaded Squid Rings, and Fish Fillets.

This they had to do before an eminent jury comprising Dr Sarika K., Senior Scientist, ICAR-CIFT, Kochi; Dr Nithin C.T., Processing & Quality Assurance Supervisor, NIFPHATT, Kochi; Shri Francis Assisi, Production Manager, Parayil Seafood Pvt. Ltd.; Shri Jayan Jacob, General Manager, Sandhya Aqua Exports Pvt. Ltd.; and Mr Vijayakrishna, General Manager, VKM Foods.

The panel assessed the participants based on technical skill, hygiene, precision, presentation and the quality of the finished products.

Shri Jawahar said the Olympiad represents an important milestone in building a resilient and globally competitive seafood sector capable of meeting the evolving expectations of international markets.

“MPEDA is making credible efforts to put emphasis on quality assurance, food safety, processing excellence, skilled workforce, sustainable



seafood production, and reliable supply chains. The Olympiad then becomes the vehicle through which India is strengthening its export ecosystem,” he added.

The event was attended by senior officials from the Central and state governments, seafood exporters, international buyers, industry leaders, technical experts, and delegates participating in Seafood Expo Bharat 2026.

The award-winning value-added seafood products prepared by the finalists were showcased at the Skill Olympiad Pavilion, along with live demonstrations and tasting sessions featuring export-oriented seafood value-added products developed through MPEDA's training programmes.

A tasting session of the value-added seafood products was also held in the MPEDA's Skill Olympiad pavilion.

In the run up to the event, MPEDA had conducted 50 Seafood Value Addition Training Programmes across the East and West coasts of India, through which more than 2,500 seafood processing workers and professionals were trained to prepare marine products in high demand in international markets.

The regional rounds were held in Mumbai (West Coast Zone) and in Visakhapatnam (East Coast Zone). The ten finalists were selected from among contestants in the regional rounds of the Olympiad on June 30.

Government of Tanzania officially launches world aquaculture Tanzania 2026 (WA26T)



On Monday, July 13, 2026: The government of Tanzania, through the Ministry of Livestock and Fisheries (MLF), officially launched the World Aquaculture Tanzania 2026 Conference (WA26T). This event marks a significant step in building both national and international momentum for the conference and mobilizing participation from government institutions, private sector, development partners, academia, and other stakeholders. WA26T is scheduled to take place from December 1 to 4, 2026.

The launch event was held at the Tanzania Fisheries Corporation (TAFICO) premises in Dar es Salaam and officiated by the Minister of Livestock and Fisheries Honorable Ambassador Dr. Bashiru Ally Kakurwa (MP), along with several high-level delegates from the Ministry. The event included the signing of

the conference's hosting agreement, which outlines the roles and responsibilities of both the WAS and MLF. Additionally, the conference theme, branding, organizational arrangements, and partnership opportunities were unveiled, establishing Tanzania as a preferred destination for international conferences, investment, and sustainable Blue Economy development.

Representatives from MLF, local universities, research institutions,

industry representatives—including the Aquaculture Association of Tanzania (AAT), WAS members, media, and various support entities—also attended the launch and witnessed the signing ceremony. Virtual statements of solidarity were issued by the African Union Development Agency (AUDA-NEPAD), the Southern African Development Community (SADC), and Aller Aqua – which is WAS African Chapter Corporate Sponsor.

The WAS's World



Aquaculture Conferences are the premier annual gatherings of aquaculture scientists, industry leaders, policymakers, investors, development partners, and other key stakeholders. Organized by the WAS in collaboration with host countries and partners, the conferences serve as leading global platforms for sharing knowledge, showcasing innovations, fostering partnerships for advancing sustainable aquaculture development.

In recognition of Tanzania's rapid growth in aquaculture and its commitment to advancing the Blue Economy, the WAS has selected the Ministry of Livestock and Fisheries to host the WA26T Conference at the Julius Nyerere International Convention Centre (JNICC) in Dar es Salaam, under the theme "Aquaculture Driving Blue Transformation."

The conference is expected to attract more than 2,000 delegates from over 100 countries, placing Tanzania at the forefront of global discussions on sustainable aquaculture, food security, aquatic food systems, investment, innovation, and the Blue Economy. It will feature keynote addresses from internationally renowned



experts, scientific and technical presentations, policy dialogues, business-to-business networking opportunities, and an international exhibition showcasing the latest technologies, products, and services across the aquaculture value chain. This event will be a unique opportunity for Tanzania to highlight its achievements, investment potential, research capability, and innovations while strengthening collaboration with global partners.

The launch event also included the official release of the Aquatic Foods Recipe Book – Tanzania, developed by the Government of Tanzania in collaboration with WorldFish and Aquatic BioSolutions Tanzania (ABiST) under the Programme for Improving Fisheries Governance and Blue Economy Trade Corridors in the SADC Region (PROFISHBLUE). The publication aims to

promote the consumption of aquatic foods, strengthen fisheries and aquaculture value chains, improve nutrition, and create new market opportunities for aquatic food products. The digital version of the book can be found [here] (<https://digitalarchive.worldfishcenter.org/items/8f9fcfc9-306a-4da7-9e08-e05cfb1a0cd9>).

worldfishcenter.org/items/8f9fcfc9-306a-4da7-9e08-e05cfb1a0cd9).

The WAS is pleased to invite conference sponsors, exhibitors, presenters (abstracts), and the general aquaculture community to register and prepare to be in Tanzania on 1-4 December, for WA26T. This conference is hosted by the United Republic of Tanzania through the Ministry of Livestock and Fisheries and Ministry of Fisheries and Blue Economy (Zanzibar), along with key sponsors such as AUDA-NEPAD, and various WAS Global Premium Sponsors.

For more information on registration, exhibition opportunities, abstract submissions, special sessions, travel details, and other relevant information, please visit the official WA26T website. <https://was.org/meeting/code/afraq26>. For general inquiries, contact the WAS-AC Secretariat at africanchapter@was.org.

Shrimp feed price reduced by Rs. 2 per kg

Gotumukkala, State President of the Shrimp Farmers Association Bhimavaram Urban, Newsday: Even though Andhra Pradesh CM Chandrababu Naidu has ordered a reduction in shrimp feed prices, manufacturers are not responding properly. Prawn Farmers Association State President Gottumukkala Gandhi Bhagwan Raju said. He spoke at the state committee meeting of the association held in Bhimavaram, West Godavari district on

Wednesday. He said that while the price was to be reduced by Rs. 4 per kg as per the promise given to the farmers, only Rs. 2 was reduced. He demanded that it be reduced by Rs. 8 per kg immediately. He asked the purchasing companies to continue the price of 30 count prawns at Rs. 400. He said that he would once again talk to CM Chandrababu and Minister Atchannaidu on these issues. Association leaders M. Tulasiram, GKF Subbaraju and others participated.





AQUACULTURE PROBIOTICS EXPERT



Nuri
NET 200g **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



Nuri BSL

Purification of upper and middle layer water



Uni-Light

Purification of bottom soil



Food for Algae & Probiotics

Inorganic matter



Food for Algae & Probiotics

Small molecule organic matter



Food for Algae & Probiotics

Feces, uneaten feed (protein, starch, cellulose)



Food for Algae & Probiotics

UNI-LIGHT PSB



Food for Algae & Probiotics

UNI-LIGHT PSB



Food for Algae & Probiotics

UNI-LIGHT PSB



UNI-LIGHT PSB Function:

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

BSL Dosage:

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

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

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Interview with Dr Foluke Areola, President, World Aquaculture Society



Dr Foluke Areola

Nigerian fisheries and aquaculture expert, Dr Foluke Omotayo Areola has now officially assumed office as the President of the World Aquaculture Society (WAS). She formerly took charge on 2 June 2026 on the sidelines of the World Aquaculture 2026, Singapore.

The following interview was conducted by the Secretariat of the World Aquaculture Society, African Chapter (WAS-AC) to learn more about Dr Areola's role and journey in serving in the World Aquaculture Society.

1. Who is Dr Foluke Areola?

Foluke Omotayo Areola is a renowned Nigerian fisheries and aquaculture professional, mentor, administrator, and international development expert with more than four decades of distinguished service in the fisheries and aquaculture sector. She is widely recognized for her pioneering leadership in Africa and globally, particularly for advancing sustainable



Dr Wendy Seale, former WAS President, hands the mantle to Dr Foluke Areola, the incoming President of WAS in Singapore.

aquaculture, food security, youth empowerment, women's participation, and professional capacity building. She is the first African elected President of the World Aquaculture Society, making history for the African continent.

2. Briefly describe your academic journey and background

My academic journey was driven by a passion for food systems, aquatic resources, and community development. I pursued formal training in fisheries and aquaculture sciences at the University of Ibadan, Nigeria, and at Humberside College of Higher Learning, Grimsby, England. I also completed short courses, including the Science-Policy Lab (S-PoL) on Innovations for Sustainable Aquatic Food Systems at the South African Department of Forestry, Fisheries, and the Environment (DFFE); the USDA: Ahmadu Bello University, Zaria, Nigeria/ Nigeria Agricultural Quarantine Service short

course on Sanitary and Phytosanitary measures for food security and international trade; and the MASHAV/CINADCO training program on intensive aquaculture production, Israel, among others. These experiences laid the foundation for my lifelong career in fisheries administration, aquaculture development, policy, extension, and institutional leadership. Over the years, I complemented my academic training with extensive professional development, international exposure, technical training, and continuous learning through engagement with global experts, institutions, and development programs. This journey culminated in my earning a PhD in Fisheries from Lagos State University, Lagos, Nigeria.

3. Briefly describe your professional journey

My professional journey spans more than 40 years across public service, professional associations, academia-linked initiatives, consulting, policy advisory services, and international development. I served in various technical and leadership roles within the Federal Department of Fisheries in Nigeria and rose to become the Acting Federal Director of Fisheries, Acting Director of Fisheries and Aquaculture, and Director of Fisheries Quarantine Services. I also became the first female National President of the Fisheries Society of Nigeria. After retiring from government service, I continued to contribute nationally, regionally, and globally as a



Dr Foluke Areola presents a Certificate of Appreciation (on behalf of the WAS) to Stellenbosch University, South Africa for its contributions to the establishment of the WAS African Chapter. The event was witnessed by Mr Narend Singh (in middle), the former Deputy Minister of the Department of Forestry, Fisheries and Environment (DFFE) in South Africa.



Dr Foluke Areola presents a WAS Honorary Award to Mr Blessing Mapfumo (WAS), for his outstanding service in establishing the WAS-AC, witnessed by Hon. Ezzedine Ben Cheikh, Tunisian Minister of Agriculture, Water Resources and Fisheries and other high-level delegates from Africa.

consultant, mentor, trainer, speaker, and advocate for sustainable aquaculture and fisheries development.

4. What inspired you to venture into the profession of fisheries and aquaculture?

I was inspired by the enormous potential of fisheries and aquaculture to improve livelihoods, nutrition, food security, employment, and rural development. I also recognized early that aquatic resources are essential for sustainable development, especially in developing countries. The profession gave me an opportunity to contribute meaningfully to humanity through food production, community empowerment, and the sustainable management of aquatic ecosystems. Fish is an important component

in the diet of my rural community, and therefore, my interest in aquaculture emanates from a deeply rooted foundation.

5. Iconically, you were the first Director of Fisheries Quarantine in Nigeria. Briefly describe your role and achievements, challenges?

Serving in a pioneering leadership role within Nigeria's fisheries administration was both a privilege and a responsibility. My role included strengthening fisheries governance, improving regulatory systems, promoting aquaculture development, supporting fish health and biosecurity, and facilitating stakeholder coordination across the sector.

Some key achievements included:

- strengthening fisheries quarantine and fish health systems;
- supporting aquaculture expansion initiatives;
- promoting professionalization within the sector;
- advancing women's participation;
- and contributing to national and international fisheries engagements.

The challenges included limited funding, inadequate infrastructure, weak policy implementation systems,

National President of the Fisheries Society of Nigeria (FISON), my focus was on strengthening professionalism, mentorship, institutional visibility, and stakeholder collaboration across the fisheries and aquaculture sector.

Some achievements included:

- strengthening the visibility and influence of FISON nationally and internationally;
- encouraging youth and women's participation;
- supporting scientific



Dr Areola showcasing her cultural dance moves at the opening ceremony of the Regional Conference on Aquaculture 2023, Abeokuta, Nigeria

low levels of technological adoption, and the need to overcome gender-related barriers in traditionally male-dominated leadership spaces. However, I truly appreciate the mentors who shaped me into the professional I have become over the years, and hence my strong inclination towards mentoring others.

6. You were also the First Female President of the Fisheries Society of Nigeria. Briefly describe your role, achievements, and challenges.

As the first female

exchange and conferences;

- promoting collaboration among academia, industry, and government;
- and enhancing institutional cohesion within the Society.

As President, I also secured a grant from the World Bank's MSME Nigeria Project, implemented nationwide best-practice aquaculture training programs, strengthened members' professional development, and increased youth



Dr Areola sharing a delightful moment with former President of WAS, Dr David Cline



Dr Areola welcoming Uganda's Vice President, Her Excellency Jessica Rose Epel Alupo to officiate the opening Ceremony of the World Aquaculture Safari 2025, Uganda

participation in the sector.

The challenges were similar to those facing many professional bodies in developing countries, including funding limitations, institutional sustainability, and the balancing of diverse stakeholder expectations.

7. Upon retirement from the Government, you took a stint as a national and international fisheries and aquaculture Consultant. Briefly describe some of your iconic projects.

After retiring, I remained deeply involved in fisheries and aquaculture development through advisory work, mentorship, and international collaborations. I transitioned to national and international consulting. Notable engagements include work with FAO, AU-IBAR, WWF Norway, OHDI, FCWC, and other partners. I have led and supported iconic projects, including: a review of national fisheries policies for AU-IBAR; a midterm review of the Sustainable Blue Economy Program (WWF Norway); and the development of the first Aquaculture Welfare Training Guides

for Nigeria, now used across Africa. My work has focused primarily on aquaculture development planning, value chain strengthening, fish farmer training, youth and women's empowerment programs, policy advisory and institutional strengthening, conference facilitation, technical training, and international collaborations with universities, development organizations, and professional associations. I have also contributed to initiatives promoting African-led solutions for food security, blue economy development, and climate-smart aquaculture systems.

8. What inspired you to join the WAS-African Chapter and to stand for election for its highest leadership position?

I joined the World Aquaculture Society-African Chapter because I strongly believed Africa needed a stronger professional platform to amplify its voice in global aquaculture. I wanted to contribute toward building networks, mentorship opportunities, scientific exchange, and

institutional collaboration for African professionals. My decision to run for leadership was inspired by a desire to serve, unite stakeholders, strengthen Africa's global visibility, and help position African aquaculture as a major contributor to global food security and sustainable development. I received invaluable encouragement and support from peers, friends, and family, for which I am truly grateful.

9. Briefly describe your journey as President of WAS-AC for the past two years.

The journey has been demanding, inspiring, and rewarding. It has involved strengthening the Chapter's institutional visibility, expanding partnerships, mobilizing members, supporting students and young professionals, and increasing Africa's participation in the global aquaculture community. It also required resilience, diplomacy, teamwork, and strategic engagement with stakeholders across academia, industry, government, and development partners.

10. State a few highlights of your impact in leading a

vibrant Chapter of WAS?

Key highlights of my leadership of the WAS-African Chapter include rapid membership growth (454% within one year); advocating for increased student access through complimentary memberships; stronger policy engagement at continental and global levels; elevating African voices on the global WAS Board; and presiding over the annual Aquaculture Africa Conferences (AFRAQs) and regional collaborations. These initiatives led to secondary impacts, including stronger stakeholder engagement, support for students and early-career professionals, and enhanced collaborations with other aquaculture associations, universities, and development organizations; promoting conferences, technical exchanges, and scientific participation, greater collaboration across African countries; expanded visibility of African aquaculture in global forums; and sustained momentum and excitement building toward the upcoming World Aquaculture Tanzania 2026 (WA26T with AFRAQ2026), Tanzania.



Dr Areola delivering an opening remark at the Opening Ceremony of the World Aquaculture Safari, Uganda 2025

11. Where do you see African aquaculture positioned in terms of long-term sustainability, based on what you have learned?

Africa has enormous potential to become one of the world's major sustainable aquaculture regions. The continent possesses vast water resources, a youthful population, growing markets, and increasing scientific capacity.

However, sustainability will depend on:

- responsible resource management;
- strong governance;
- local feed development;
- investment in research and innovation;
- climate-smart production systems;
- professional capacity building;
- and inclusion of youth, women, and small-scale producers.

If properly supported, African aquaculture can significantly contribute to food security, employment, trade, and economic transformation.

12. What are the challenges for African aquaculture to grow? How can these be addressed?

Three major challenges continue to hinder the sector's growth and sustainability. One of the most significant issues is limited access to quality inputs and financing, as many farmers struggle to obtain high-quality seeds, feed, equipment,

and affordable financing needed to improve productivity. Addressing this challenge requires strengthening local production systems, improving investment frameworks, and establishing farmer-friendly financing mechanisms that are accessible and sustainable. Another major challenge is weak technical capacity and inadequate extension systems for farmers. Many producers lack sufficient technical guidance, modern training opportunities, and access to up-to-date agricultural knowledge. To address this gap, investment is needed in education, digital extension services, vocational training, and stronger collaboration among universities, industry, and government institutions.

Poor infrastructure and weak market systems also remain critical obstacles. Inadequate cold chain systems, limited processing facilities, poor logistics, and unorganized markets continue to reduce efficiency and profitability across the value chain. Promoting value chain development, encouraging public-private partnerships, increasing infrastructure investment, and strengthening regional trade integration are essential steps to improving market access and sector performance.

13. Iconically, you stood for the WAS Global President-Elect position, and you won! Briefly describe this monumental move?

It was both humbling



Dr Areola leading an African aquaculture delegation at the Aquaculture America Conference 2026, Las Vegas, USA

and historic. My election reflected the growing global recognition of Africa's contributions and potential in aquaculture. It also demonstrated confidence in inclusive leadership, diversity, and the importance of bringing broader global perspectives into international professional governance. For me, it was not just an individual achievement but a victory for Africa, women, and emerging aquaculture professionals across the Global South. Finally, I am a strong believer in God. To me, this opportunity informs me that God needs me to rise to the occasion, take responsibility, fulfill the duties of the position, and thus glorify His Name. I am certain that He does not expect me to do this alone. My role is to be a leader who is humble enough to recognize the talent in others so that together we fulfill our purpose of bettering the experience of His creation.

14. You are now on record as the first President of WAS Global from the African Continent. What does this mean?

It means Africa now has

a stronger voice and representation in global aquaculture leadership. It signifies recognition that solutions to global food security and sustainable aquaculture must meaningfully include Africa. It also sends a strong message to young professionals, especially women and youth, that leadership is attainable regardless of background or geography. I hope it inspires future generations to actively participate in global scientific and professional leadership.

15. Any message to inspire women in aquaculture and the young generation of aquaculture professionals out there?

Believe in your capacity, remain committed to excellence, and never underestimate the value of persistence, integrity, and continuous learning. Do your best at all times. Our duty is to do our best and to leave the rest to God. Aquaculture offers vast opportunities for innovation, entrepreneurship, science, sustainability, and service to humanity. Young professionals and women should not be discouraged

by barriers. Every challenge can be an opportunity for growth and leadership. Mentorship, collaboration, discipline, and passion are essential to long-term success.

16. This year, the UN has declared 2026 as the International Women Farmer. What message would you wish to relay to millions of women fish farmers and aquaculture professionals out there?

Women are central to food systems, family welfare, nutrition, and community resilience. Across Africa and the world, women fish farmers and aquaculture professionals continue to make invaluable contributions despite numerous constraints.

My message is:

- continue believing in your potential;
- seek knowledge and foster innovation;
- support one another;
- and remain active participants in leadership and decision-making.

Governments and institutions must also invest more deliberately to empower women by expanding access to land, financing, technology, education, markets, and leadership opportunities.

17. Any special message to aquaculture audiences?

I encourage everyone to become active participants in strengthening the future of aquaculture through professionalism, collaboration, innovation, and sustainability.

I especially encourage:

- membership in the World Aquaculture Society;
- mentorship and support for students and young professionals;
- participation in and other scientific platforms;
- and stronger collaboration among academia, industry, governments, and development partners.

The future of aquaculture in Africa is bright, but it requires collective effort, ethical leadership, investment in people, and a commitment to sustainability. Africa must not only participate in global aquaculture — Africa must help shape its future.

To learn more about Dr Foluke Areola, refer to her Acceptance Speech at the Presidential Inauguration Ceremony in Singapore (June 2026).

https://was.org/_documents/Dr_Foluke_Areola_Acceptance_Speech.pdf

Dr Areola is scheduled to participate and officiate the World Aquaculture Tanzania 2026 (WA26T), scheduled for 1-4 December 2026 in Dar es Salaam. Be sure to be part of the Conference to connect with this esteemed champion in the global aquaculture field!. For more details about WA26T, visit <https://was.org/meeting/code/AFRAQ26>

World Aquaculture Society Secretariat, Africanchapter@was.org.

IMIA pushes 'One India-One Fishery Improvement Project' for sustainable marine ingredients sector

Harmonised national FIP framework would strengthen India's credibility in international markets, improve access to sustainability-focused buyers and reduce duplication of efforts, says IMIA President



The association has been actively promoting the sustainable development of the fishmeal and fish oil (FMFO) industry.

The Indian Marine Ingredients Association (IMIA) is spearheading a national initiative to strengthen the sustainability and global competitiveness of India's marine ingredients sector.

The association has been actively promoting the sustainable development of the fishmeal and fish oil (FMFO) industry through responsible sourcing, improved resource utilisation, scientific management, and stakeholder collaboration.

Mohamed Dawood Sait, President of IMIA, said the association's vision is to create a unified and credible sustainability framework for India that supports fishers,

strengthens industry collaboration, and enhances the country's standing in global markets.

He pointed out that the marine ingredients sector plays a vital role in the national economy while supporting the livelihoods of thousands of fishers and workers across the fisheries value chain. The industry utilises low-value, short-lived and naturally abundant pelagic fish species, along with fish processing by-products, unavoidable by-catch and post-harvest losses, thereby promoting efficient resource utilisation and the principles of a circular economy.

Recognising the need for a unified national approach to fisheries sustainability, Sait said IMIA has been advocating the concept of "One India-One Fishery Improvement Project (FIP)." A harmonised

national FIP framework, he said, would strengthen India's credibility in international markets, improve access to sustainability-focused buyers, reduce duplication

of efforts, and provide a coordinated pathway for responsible fisheries management across the country.

Representatives of IMIA and industry stakeholders

from various coastal states expressed support for a nationally coordinated Fishery Improvement Project and underscored the need for collective action, stakeholder cooperation,

and sustainable fisheries management practices to ensure the long-term future of India's marine fisheries and marine ingredients industry, he said.

Courtesy: AGRI BUSINESS

The real crisis in India's fisheries

Context

- The Government of India, citing CMFRI data, claimed that 91.1% of 135 evaluated fish stocks were "sustainable" in 2022, projecting India's marine fisheries as a global success story.
- However, this optimistic picture contrasts sharply with FAO's assessment, which describes Indian marine fisheries as having plateaued due to overcapacity, and with decades of fisher testimony reporting declining catches and vanishing species.

Key Concerns with Official Claims

- Methodology Used: Compared with many other fishing nations, CMFRI continues to rely primarily on landing data rather than stock assessments.
 - It calculates the availability of fish stocks in India's Exclusive Economic Zone (EEZ) — which includes up to 200 nautical miles (371 km) of sea area around the country, based on what fishermen catch.
 - Other nations make use of stock assessments at sea itself, thereby

calculating how much aquatic life is available in certain waters.

- This is the more reliable method to determine the health of fish stocks.
- Decline of Inshore Ecosystems: India is surrounded by a relatively narrow continental shelf, where fishing is always the most productive. This continental shelf is broadest in Gujarat and a part of Maharashtra, but remains quite narrow along the rest of the sub-continent.
 - These waters provide favourable ecological conditions for commercially valuable species such as shrimp to feed, breed and grow.
 - The construction of dams on rivers and destruction of mangroves impact the inshore fishing more than it impacts the distant waters.
- Mechanised Trawling: One of the many factors contributing to decline of fisheries is the expansion of mechanised trawling, which was introduced in around 1960.
 - This oversized fleet

of mechanised trawlers ploughs the inshore seabed in a continuous fashion.

- In heavily trawled areas, this results in a decline of all animal and plant life.

Governance Failures

- The 5 nautical mile no trawling zone meant to protect inshore waters for small scale fishers is poorly enforced.
- Coastal states lack adequate patrolling staff and vessels.
- Fishers themselves are excluded from co management arrangements, weakening compliance and local monitoring.
- Result is both small scale and mechanised fishers are being pushed toward overcrowded offshore and deep sea zones.

Government Initiatives to Protect Fisheries in India

- Marine Fishing Regulation Acts (MFRAs): 'Fisheries' is a State Subject, all coastal States and Union Territories (UTs) are governing marine fisheries through their respective MFRAs.
- Pradhan Mantri Matsya Sampada Yojana (PMMSY): It is being

implemented for the overall development of the fisheries sector and socio-economic wellbeing of traditional and small-scale fishers.

- The activities such as mariculture including seaweed cultivation and open sea cage culture are promoted under PMMSY to alleviate the fishing pressure in nearshore waters, and boost marine fisheries production in a sustainable manner.
- The PMMSY also includes a component "Development of 100 Coastal Fishermen Villages as Climate Resilient Coastal Fishermen Villages (CRCFV)",.
- National Policy on Marine Fisheries 2017: It guides responsible and sustainable fishing in the country.
- Government Advisories: Paired bottom trawling or bull trawling and use of LED lights in fishing are banned in the Exclusive Economic Zone (EEZ) of India.
 - GoI has also advised coastal states/UTs to review and amend their respective MFRAs to ensure mandatory use of Turtle Excluder Devices (TEDs) towards marine turtle

Sri Venkateswara Aquaculture, the big name in 1990s



Ch. Satyanarayana Reddy

In 1993 Mr Ch. Satyanarayana Reddy, Managing Director, Sri Venkateswara Aquaculture,



Ch. Satyanarayana Reddy and M.A. Nazeer during the Editor's visit in Kakinada recently

Kakinada started shrimp culture in 100 acres and developed it to 200 acres farm. In 1996 he took up distribution of CPF India for Starfeed with 700 tonnes sale in the first year and went upto 3000 tonnes of Blanca and sold upto 3000 tonnes of CPF Feed. In 1998 he started shrimp hatchery with the name of Sri Venkateswara Shrimp Hatcheries Pvt Ltd with Tiger seed and developed three hatcheries with an annual production of 300 million seed.

India joins WTO fisheries subsidies agreement to promote sustainable fishing

Aquaculture and inland fisheries remain outside the agreement's scope, ensuring continued support for India's shrimp export sector

The pact prohibits subsidies that support illegal, unreported and unregulated fishing and the exploitation of overfished stocks, while promoting sustainable fisheries and protecting the livelihoods of small-scale fishers. | Photo Credit: JOTHI RAMALINGAM B

India on Monday announced that it has joined the WTO's agreement on fisheries subsidies, which prohibits government support to illegal fishing activities and over-exploitation of stocks.

The agreement focuses on subsidies related to marine wild capture fishing and fishing-related activities at sea.

However, aquaculture and inland fisheries remain outside the scope of this pact, which came into force on September 15, 2025.

First WTO environmental

sustainability agreement

The agreement was adopted by consensus at the 12th WTO Ministerial Conference in Geneva in June 2022. It is the first multilateral WTO agreement with an environmental sustainability objective.

"India deposited its Instrument of Acceptance of the WTO Agreement on Fisheries Subsidies (AFS) on 20th July 2026, thereby becoming a Party to the Agreement," the commerce ministry said in a statement.

The formal acceptance was handed over by the Commerce Secretary Rajesh Agrawal to the Director-General of the World Trade Organisation (WTO) Ngozi Okonjo-Iweala in Geneva. Agarwal is in Geneva for an official visit.

Focus on sustainable

fisheries and small-scale fishers

The agreement, it said, protects the livelihoods of traditional and small-scale fishers by promoting sustainable fisheries.

It prohibits subsidies linked to illegal, unreported and unregulated (IUU) fishing and fishing of overfished stocks, as it aims to address unsustainable fishing practices that threaten marine resources.

The pact also creates a more equitable global fisheries regime by disciplining harmful subsidies that support large, heavily subsidised industrial fishing fleets being operated by distant water fishing nations.

"This benefits countries like India, where fisheries are predominantly small-scale and which are not major participants in industrial fishing," it said, adding

that the predominance of aquaculture-based shrimp in India's seafood exports, which fall outside the scope of the agreement, ensures the continued resilience and competitiveness of the country's seafood export sector.

The pact also seeks to promote the conservation and sustainable use of marine fisheries resources while providing appropriate flexibilities for developing and least-developed country members.

It added that India's domestic fisheries management framework is in alignment with the agreement and safeguards the interests of traditional and small-scale fishers.

The agreement entered into force only after two-thirds of WTO members (166 at present) deposited their instruments of acceptance.

Once that threshold was reached, the pact became legally effective for those countries that had accepted it.

Courtesy: AGRI BUSINESS

Contd. from page 25

conservation.

- Uniform Ban Period on Fishing: For enhancement of the fish stocks and sea safety reasons the uniform ban on fishing for 61 days is implemented annually in the EEZ beyond territorial waters on both the coasts (i.e., 15th April to 14th June in the East Coast, and 1st June to 31st July in the West Coast).
- The National Fisheries Development Board (NFDB), and the R&D Institutions have undertaken a series of initiatives in association with State Fisheries Departments to raise awareness on critical threats to the fisheries sector.

Way Forward

- Shift from landing data to scientific stock assessments for credible sustainability claims, aligning with global best practices.
- Strengthen inshore zone enforcement through better state capacity, satellite/AIS based monitoring, and community co management involving fisher cooperatives.
- Restrict mechanised fleet expansion, particularly engine upgrades that increase trawling intensity, and enforce the 5 NM boundary strictly.
- Address land based stressors: mangrove restoration, pollution control, and environmental flow requirements for rivers feeding coastal

Centre releases Rs 2,208.74 crore to states for big push to fisheries sector



New Delhi, July 22 : The Department of Fisheries has released Rs 2,208.74 crore to the states, during the last three financial years from 2023-24 to 2025-26, under the flagship scheme of the Pradhan Mantri Matsya Sampada Yojana (PMMSY) for holistic development of fisheries and aquaculture sector in the country, the Parliament was informed on Wednesday.

India's fish production has jumped by 39.61 per cent from 141.64 lakh tonne in 2019-20 to 197.75 lakh tonne in 2024-25 while fisheries exports have surged by 58.34 per cent from Rs 46,666 crore in 2019-20 to Rs 73,890 crore in 2025-26, reflecting the success of the blue revolution, Fisheries,

Animal Husbandry and Dairying Minister Rajiv Ranjan Singh said in response to a question in the Rajya Sabha.

The Centre approved a total allocation of Rs 3,159.83 crore during this period. State-wise allocation of Central funds under PMMSY are made on annual basis depending on the overall budgetary allocation, performance of the States and UTs, fund absorbing capacity, physical and financial progress, liabilities created in respect of the projects approved in the previous financial years.

There is no disparity in allocation of funds among the States and Union Territories under the PMMSY. The fisheries and

aquaculture development projects and initiatives taken by the Department of Fisheries under the PMMSY have contributed towards augmentation of fish production, productivity and exports, the minister explained.

The Department of Fisheries has developed the PMMSY Management Information System as a centralised digital portal and dashboard utilised to track the progress of the Fisheries projects taken up under Pradhan Mantri Matsya Sampada Yojana (PMMSY), the minister further stated.

The PMMSY Management Information System aggregates district and state-level data to enable monitoring and evaluation of the progress. Issuance of need-based advisories, regular physical and virtual meetings with the States and Union Territories are followed up with field visits to monitor and review the progress of projects and improve the effective utilisation of funds, the minister added.

Courtesy: IANS

ecosystems.

- Recalibrate deep sea fishing policy as a supplementary, not primary, strategy, given limited biological potential.
- CMFRI mandate expansion to include systematic benthic ecosystem health studies, not just catch based sustainability

indices.

- Bilateral engagement with Sri Lanka on Palk Bay fishing through structured, time bound transition mechanisms away from bottom trawling.

Conclusion

- India's marine fisheries policy suffers from a data credibility gap and a governance vacuum

in the most ecologically productive inshore zone.

- Genuine sustainability requires moving beyond output centric optics toward science based stock assessment, inshore ecosystem restoration, and inclusive fisheries governance that balances livelihoods with ecological limits.

Courtesy: THE HINDU

Single-cell protein replaces 50% of fishmeal in seabream diets

A study shows the potential of bacterial single-cell protein in a key Mediterranean species and provides new data on digestibility, gut health and disease resistance.



*Federico Melenchón Ramírez,
Product Manager Functional
Health Ingredients at Unibio*

July 21, 2026: As the aquafeed industry continues to diversify its ingredient portfolio beyond fishmeal and fish oil, alternative protein sources such as single-cell proteins have emerged as promising solutions. Among them, bacterial single-cell proteins (BSCPs) have demonstrated nutritional benefits in salmonids and shrimp.

A recent study evaluated the digestibility and nutritional value of BSCP produced from methane-oxidizing bacteria as an alternative protein source for gilthead seabream (*Sparus aurata*). The BSCP ingredient, Uniprotein®, supplied by Unibio, was evaluated in five experimental diets in which fishmeal was replaced at graded levels of 25%, 50%, 75%, and 100%, with a fishmeal-based diet serving as the control. The diets were fed to non-vaccinated gilthead seabream juveniles for 96 days, followed by a *Vibrio harveyi* challenge to evaluate disease resistance.

Same performance at 50% fishmeal

replacement

Results indicated that replacing up to 50% of the fishmeal with BSCP had no adverse effect on performance. Fish fed this diet maintained growth performance and feed efficiency while preserving physiological homeostasis, supporting a favorable intestinal microbiota and maintaining disease resistance. In contrast, fish fed diets with 75% and 100% fishmeal replacement exhibited reductions in final body weight of 9.1% and 20.1%, respectively.

According to the authors, the reduced performance observed at the highest inclusion levels was primarily associated with lower feed intake, suggesting reduced palatability, and with lower dietary concentrations of long-chain polyunsaturated omega-3 fatty acids (mainly EPA and DHA) in diets with complete fishmeal replacement.

From a nutritional perspective, protein digestibility remained comparable to the control diet at replacement levels up to 75%, while complete

fishmeal replacement resulted in lower protein digestibility. No significant differences were observed in the apparent digestibility coefficients of crude lipid or dry matter between the BSCP-containing diets and the control. Likewise, the digestibility of both essential and non-essential amino acids remained stable across the different BSCP inclusion levels.

Gut microbiota and disease resistance

BSCP inclusion also modulated the intestinal microbiota of gilthead seabream. Notable changes included increased microbial diversity, enrichment of beneficial taxa such as *Candidatus* *Arthromitus*, and a reduced relative abundance of potentially pathogenic genera, including *Photobacterium*. These changes suggest an improvement in gut microbial balance and a greater capacity to limit the establishment of opportunistic pathogens.

The disease challenge showed that replacing up to 75% of the fishmeal with BSCP did not compromise survival following infection

with *Vibrio harveyi*. However, complete fishmeal replacement reduced disease resistance, an effect the researchers attributed primarily to deficiencies in essential dietary fatty acids rather than to the bacterial protein itself.

Commercial implications for Uniprotein

For Unibio, the key takeaway is that Uniprotein can replace up to 50% of the fishmeal in gilthead sea bream diets, including those containing high levels of Super Prime fishmeal, without compromising growth performance or feed conversion.

"The microbiota also shifted toward populations associated with improved performance and away from potentially pathogenic strains. This follows the trend observed in previous studies, where similar inclusion levels of Uniprotein (5-10% of the diet, replacing moderate amounts of fishmeal) have been successfully used in species such as shrimp and rainbow trout. The significance of this study is that it demonstrates comparable results in a warm-water Mediterranean species, extending the evidence base beyond the cold-water species where microbial proteins have traditionally been evaluated," Federico Melenchón Ramírez, Product Manager Functional Health Ingredients at Unibio, told Aquafeed.com.

Facing uncertainty over marine ingredient supplies due to geopolitical tensions and the new El Niño. Beyond the environmental benefits of alternative



proteins, supply security and price stability are becoming increasingly important considerations.

"Our single-cell protein is a good example. Because it is produced through gas fermentation, the feed stock is methane rather than a wild-caught marine resource. As a result, production remains stable throughout the year regardless of what is happening at sea. This allows feed manufacturers to secure part of their protein supply independently of the marine ingredient market and formulate diets with much greater confidence," Melenchón Ramírez said.

To support commercial deployment, Unibio is scaling production through an 80:20 joint venture with Saudi Industrial Investment Group (SIIG) to build a large-scale production facility in Jubail, Saudi Arabia. The location provides access to abundant, low-cost natural gas, helping ensure a competitive and predictable feed stock supply.

Building the evidence base

According to Melenchón Ramírez, commercial adoption ultimately depends on more than growth performance alone.

"Growth remains the entry ticket, but manufacturers are also looking for reliability together with scalability, so sufficient volumes are available for commercial feed production, and price and quality that can compete with established ingredients," he said.

"Increasingly, they also want evidence beyond

growth trials, including digestibility, gut health, physiological responses, disease resistance and final product quality. That is where studies like this become commercially valuable."

While scaling production, Unibio is continuing to validate Uniprotein in commercially important aquaculture species. Following gilthead seabream, European seabass and barramundi are the company's next research priorities. Additional shrimp trial results are also expected to be released soon, with further species evaluations planned over the next two years.

"Our objective is to provide formulators with the scientific evidence needed to qualify Uniprotein as a standard feed ingredient because of its proven nutritional value, not simply because fishmeal prices are high. Beyond its amino acid profile, we are also building the scientific case for Uniprotein as a reliable and rich source of nucleotides," Melenchón Ramírez concluded.

Reference

Enric Gisbert, Alberto Ruiz, Federico Melenchón, Yanis Cruz-Quintana, Dolors Furones, Ignasi Sanahuja, Silvia Torrecillas, Nana W. Thorninger, Bacterial single cell protein from methanotrophic bacteria as an alternative ingredient for gilthead seabream (*Sparus aurata*) aquafeeds: Effects on digestibility, growth performance, gut microbiota, and disease resistance, *Aquaculture*, Volume 625, 2026, 744316, ISSN 0044-8486.

Courtesy: AquaFeed

If farmers go for Crop Holiday for one year all over India, it will settle all the issues and farmers can get profitable rate for shrimp raw material; it also helps to prevent diseases

Says K. Murthy Raju, a senior stakeholder in Kakinada



K. Murthy Raju, Proprietor, Sri Surya Agencies, Kakinada

Kakinada: A senior most stakeholder in Kakinada, Andhra Pradesh Mr K. Murthy Raju, Proprietor, Sri Surya Agencies said that due to low quality seed shrimp culture is facing problems. Besides its input cost is doubled and farmers are paying Rs 80,000 to Rs 100,000 for pond lease, labour cost has also gone up abnormally which is leading to losses to the farmers. If crop is successful farmers can make some money inspite of problems, but at times crop is also not good, he added.

In 2000s, if three crops are failed and with one successful crop farmers used to settle old dues and were happy. But today, things are different, they are not making money, said Murthy Raju.

Though farmers are doing crop with interest due to lack of proper management they are losing the crop. I have been in the industry for more than 25 years and I found seed quality was not upto the mark, with this good farmers are also affected, he stated.

We need crop holiday

There is a need of crop holiday every year in order

to make the pond healthy and suitable for shrimp culture, said Mr Murthy Raju.

Murthy Raju felt that if farmers go for crop holiday for one year all over India exporters and other segments business people will settle and farmers can get profitable rate for shrimp raw material. Crop holiday will also help to prevent diseases in the ponds.

He appealed to the shrimp exporters to ensure fair and profitable price to shrimp raw material, then only farmers can sustain and continue to work with interest the culture.

K Murthy Raju started Sri Surya Agencies in the year 2000 with Maxwell Feed of Bommidala Group, Guntur and sold 500 tonnes of feed annually. In 2002 he took Hi-Gain Feed from Hindustan Lever and in 2005 shifted to Somkan Feed in collaboration with Hanaqua and sold about 800 tonnes of feed annually. Mr R.P. Singh, the then GM of the company made this brand popular those days.

Presently dealing with Godrej Agrovet and IFB – Cargill

In 2010 he went to Godrej Agrovet for Vannamei and Fish Feed and continuing with their fish feed selling 3,000 tonnes fish feed and some quantity of Vannamei now. Sri Surya Agencies is also supplying IFB – Cargill Feed since 2025 and supplying 700 tonnes of Vannamei and Fish Feed.



Sri Varun Aqua Enterprises aims to further strengthen its position as one of Andhra Pradesh's leading aquaculture solutions

With large shrimp farming & feed distribution, Sri Varun Aqua Enterprises is a potential player in Aquaculture Sector in Andhra Pradesh



*K. Srinivas Reddy,
Managing Partner,
Sri Varun Aqua Enterprises*



*K. Sumant Reddy,
Partner,
Sri Varun Aqua Enterprises*

Talking to M.A. Nazeer, Editor, Aqua International Mr Srinivasa Reddy said that Government of Andhra Pradesh announced reducing electricity tariff for aquaculture farmers to Rs 1.50 per unit, but its not implemented so far.

Cost of production of shrimp is going up and there is a need of experts and the industry stakeholders come out with ideas to control the prices. Exporters should cooperate with farmers to give profitable price. As shrimp is a perishable food item they should not take advantage of it and cause losses to the farmers, he stated.

I saw failures at one stage and I also saw very good times. We really enjoyed aquaculture in 2013 to 2015 and it was the golden period when we got very good productivity and raw material prices, he told.

Established in 2004, Sri Varun Aqua Enterprises is one of the most experienced and trusted aquaculture feed distribution companies in the Kakinada region, Andhra Pradesh. Over the past two decades, the company has built a strong reputation for its commitment to quality, integrity, technical expertise, and prompt service, making it one of the senior-most active shrimp feed dealers in the Kakinada area.

The company is engaged in shrimp

farming, shrimp feed distribution, aquaculture healthcare products, shrimp procurement and trading, and technical advisory services. By combining scientific farming practices with quality products and personalized field support, Sri Varun Aqua Enterprises has built long-standing relationship with shrimp farmers across East Godavari and the surrounding coastal regions.

To ensure timely and efficient service, the company operates

In 1980s CPF Aqua Feed company gave a strong foundation to the Indian aquaculture sector and this company brought good awareness among farmers on culture practices, stated Mr Srinivasa Reddy. In East Godavari district 99% farmers do not use antibiotics in shrimp farming and shrimps produced in this zone are antibiotic-free.

Sri Varun Aqua Enterprises is supplying 9,000 tonnes of feed annually in East Godavari District alone. Farmers in Kakinada zone should come together to discuss and work towards development of this sector in the region, he said.

Mr K. Sumant Reddy, joined the family business in 2021 and taking active role in the company. Before joining the family business of Sri Varun Enterprises, Sumant worked as a software engineer in Samsung R&D at Bangalore for three years.



Sri Varun Aqua Enterprises outlet in Andhra Pradesh

three strategically located godowns at Kajuluru, Nadakuduru, and Ontimamidi, enabling the prompt supply of shrimp feed and



Opening Ceremony of Sri Varun Aqua Store: K. Somi Reddy (late), father of K. Srinivasa Reddy, during the inauguration of Sri Varun Aqua Enterprises. D. Diwakar Reddy, Senior Farmer, Recipient of Aquaculture Award from the then PM Rajiv Gandhi; Dr Sudhakar Babu, present MD of SRIBS; Ch. V. Surya Rao, President of Farmers Association-East Godavari District; K. Sumant Reddy, son of K. Srinivasa Reddy, Current Working Partner of Sri Varun Aqua Enterprises.

aquaculture inputs to farmers.

Sri Varun Aqua Enterprises is proud to be associated with the industry's leading feed manufacturers and is an authorized dealer for Avanti Feeds, CPF India, and iFeed, offering farmers access to some of the most trusted shrimp feed brands in the country.

2. Activities of Varun Aqua Group

Sri Varun Aqua Enterprises provides comprehensive solutions to the aquaculture industry through the following activities:

- Scientific shrimp farming.
- Distribution of premium shrimp feeds.
- Supply of aquaculture healthcare products, probiotics, minerals, feed supplements, and water treatment solutions.
- Prompt delivery of feed and emergency healthcare products during disease outbreaks and other

critical situations.

- Shrimp procurement and buyback support for farmers, including during challenging periods such as the COVID-19 pandemic.
- Technical advisory services for shrimp farmers.
- Water quality management and nutritional support.
- Biosecurity planning and disease prevention.
- Farmer education and continuous field assistance.

With a strong emphasis on quality products, scientific farming, and technical expertise,

the company continues to support farmers in improving productivity while promoting

sustainable and responsible aquaculture.

3. Key Persons

Mr K. Srinivasa Reddy, Founder & Managing Partner

Mr K. Srinivasa Reddy entered the aquaculture industry in 1993 as a shrimp farmer. Drawing on over three decades of hands-on experience, he founded Sri Varun Aqua Enterprises in 2004 with the vision of providing farmers with quality products, reliable technical guidance, and dependable service.

Despite becoming a successful entrepreneur, he continues to consider himself **a farmer first and an entrepreneur next**. This philosophy has shaped the company's farmer-first approach, where the success of farmers always takes precedence.

Known for his integrity, customer-centric approach, and deep technical understanding of aquaculture, Mr. Srinivasa Reddy has established Sri Varun Aqua Enterprises as a trusted name among shrimp farmers. His vision has always been to provide quality products backed by honest advice and dependable after-sales support, enabling farmers to achieve sustainable success.

Mr Sumant Reddy, Partner

Mr Sumant Reddy represents the second generation of leadership at Sri Varun Aqua Enterprises. After graduating from **IIIT Hyderabad** and gaining valuable professional experience in the corporate sector, he joined the family business with the objective of integrating modern management practices, technology, and scientific aquaculture into the organization.

He is actively involved in business strategy, customer relationship management, technical support, and operational development. His focus is on strengthening farmer engagement through scientific pond management, improved biosecurity, data-driven decision-making, and sustainable farming practices.

Mr M. Satish, Partner & Manager

Mr M. Satish has been one of the strongest pillars of Sri Varun Aqua Enterprises since its inception. Having been associated with the company

Sri Varun Aqua Enterprises are the Dealers for:



from the very beginning, he has played a vital role in its growth and success.

He oversees the company's sales, marketing, and business development activities while

maintaining close relationship with farmers and ensuring the efficient delivery of products and services across the region.

4. Shrimp Farming Activities

Sri Varun Aqua Enterprises follows scientific shrimp farming practices with a strong emphasis on:

- Water quality management.
- Biosecurity implementation.
- Nutritional management.
- Disease prevention.
- Sustainable farming practices.
- Continuous technical monitoring.

The company currently cultivates **Pacific white shrimp (*Penaeus vannamei*)** across **approximately 350 acres** of aquaculture farms and has adopted **advanced nursery technology** to ensure healthy post-larvae development, improved survival rates, and enhanced production efficiency.

By integrating modern farming techniques with rigorous technical supervision, Sri Varun Aqua Enterprises consistently produces high-quality, healthy shrimp while upholding the highest standards of environmental responsibility, operational excellence, and long-term sustainability.



Dad's Dearest Son: K. Srinivas Reddy and his son and partner K. Sumant Reddy

5. Feed & Healthcare Products Outlets

The company operates an efficient distribution network supported by its three godowns at **Kajuluru, Nadakuduru, and Ontimamidi**, ensuring the uninterrupted supply of shrimp feed and aquaculture healthcare products.

As an authorized dealer for **Avanti Feeds, CPF India, and iFeed**, Sri Varun Aqua Enterprises supplies premium shrimp feed along with probiotics, minerals, feed supplements, water conditioners, and other aquaculture healthcare products. The company also partners with several leading aquaculture healthcare manufacturers, including **Virbac, Kemin, Neospark, Biostadt, CPF, Avanti, Uni-President, Sanzyme,**

MSD, and other reputed brands, enabling farmers to access a comprehensive range of high-quality health and nutrition solutions.

Its outlets also serve as technical support centres, where farmers receive expert guidance on pond preparation, nutrition, water quality management, disease prevention, and the adoption of best management practices.

6. Future Plans & Targets

Sri Varun Aqua Enterprises aims to further strengthen its position as one of Andhra Pradesh's leading aquaculture solution providers by:

- Expanding its distribution network across new regions.
- Introducing in-house mobile testing laboratories to provide farmers with accurate on-site water quality analysis and shrimp microbiological testing.
- Promoting the in-house preparation of high-quality fermented probiotics and photosynthetic bacteria (PSB), enabling farmers to reduce production costs through scientifically prepared biological products.
- Expanding shrimp procurement and buyback support to include Black Tiger shrimp.
- Strengthening technical support services for shrimp farmers.
- Promoting sustainable and environmentally responsible aquaculture.
- Adopting modern technologies and scientific farm management practices.
- Expanding the portfolio of premium aquaculture products.
- Building long-term partnership with farmers through innovation, trust, and quality Service.

With over two decades of dedicated service, Sri Varun Aqua Enterprises remains committed to contributing to the sustainable growth of India's aquaculture industry while helping farmers achieve greater productivity, profitability, and long-term success.



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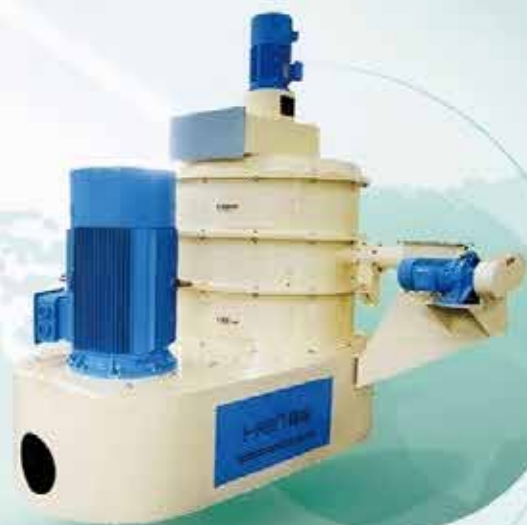
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Black Soldier Fly Larvae: Fuelling the Future of Circular Aquaculture in India

Ashby GS, Jenisha Mol JG, Raswin Geoffrey, S. Felix

St. Devasahayam Institute of Fisheries Science and Technology, Amanattanthéri, Kanniyakurari – 629 193.

Highlights: BSFL packs up to 73.35% crude protein, completely replacing costly fishmeal while supercharging fish immunity, growth, and survival. Furthermore, BSFL bioconversion drastically minimizes environmental impact, cutting feed-associated carbon emissions by 30% and slashing greenhouse gases 47 times more effectively than standard composting. Capitalizing on these eco-friendly benefits, India is uniquely positioned to establish a low-cost production model by upcycling abundant, free local resources like coconut poonac, tropical fruits, and coastal marine discards into premium BSFL aquafeed. Ultimately, this BSFL cultivation loop creates a flawless circular economy that transforms regional bio-waste into highly valuable, omega-3-enriched feed and nutrient-rich organic frass fertilizer for the local plantation sector.

Introduction:

Aquaculture is one of the fastest-growing food sectors in the world, yet it faces a critical challenge sustainable feed production. Traditionally, fishmeal and soybean meal have formed the backbone of aquafeeds, but increasing pressure on wild fish stocks and environmental concerns are driving the search for more sustainable alternatives. In this context, the Black Soldier Fly (BSF) has emerged as a promising solution. Its larvae are rich in protein (up to 45%) and essential amino acids, making them an effective substitute for conventional feed

ingredients. More importantly, BSF can be produced economically at scale, offering a cost-effective and environmentally friendly alternative to traditional fishmeal. What sets BSF apart is its remarkable ability to convert organic waste into high-quality biomass. By feeding on household and agricultural waste, the larvae transform low-value materials into nutrient-rich feed, reducing waste disposal issues while lowering the carbon footprint of aquaculture. In India, this approach is gaining momentum, with studies reporting encouraging results in species such as tilapia and other cultured fishes. With its unique combination of nutritional value, waste-to-resource conversion, and resource efficiency, including significantly lower water use compared to conventional livestock, BSF is rapidly emerging as a key component in the future of sustainable aquafeeds.

Biology and Nutritional Significance of BSF Larvae

Hermetia illucens, commonly called the black soldier fly (BSF), is a widespread Stratiomyidae species. BSF larvae (BSFL) are gaining attention for their ability to hyperaccumulate protein and fats from renewable substrates like household waste, turning it into high-quality protein. This makes them a promising, sustainable alternative protein source for fish feed, especially in aquaculture, due to their nutritional value and environmental benefits. However, further research is needed to optimize production, improve waste-to-protein efficiency, and ensure safety and regulatory compliance for BSFL-based feeds to fully unlock their potential in the global fish-feed industry. BSF

larvae and pupae are rich in chitin (14.5% and 18% respectively), a non-toxic, biodegradable polymer with fungicidal and nematocidal properties. Chitin can trigger plant defense mechanisms and benefit soil health by promoting chitin-degrading bacteria, like Gamma proteobacteria. BSF farming is highly water-efficient, using up to 95% less water than traditional livestock like cattle or pigs, freeing up resources.

Nutritional Profile of BSFL

BSF larvae aren't just a protein source; they're a functional feed ingredient. Their composition varies based on the substrate:

Parameters	% dry weight
Crude protein	39.38_73.35%
Crude fat	0.83_38.36%
Crude fiber	7.41_14.8%
Ash	7.26_12.8%
Moisture	3.21_54.78%

Source: Weko et al., 2023



Black soldier fly



Black soldier fly larvae

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Black soldier fly meal

The Black Soldier Fly (BSF) represents a powerful example of a circular economy, where organic waste is efficiently converted into valuable resources. The larvae feed on a wide range of waste materials, significantly reducing landfill burden while transforming low-value substrates into nutrient-rich protein for animal feed. In the process, they also produce high-value by-products such as biodiesel lipids and organic fertilizers, contributing to resource recovery and environmental sustainability. Notably, BSF by-products can help reduce zoonotic pathogens, improving the microbiological safety of waste-derived fertilizers. Their remarkable efficiency comes from converting up to 50% of organic

Species-Specific Inclusion Levels and Benefits:

Species	Recommended Inclusion/ Replacement Level	Key Benefits & Findings
Tilapia	50%_75% fishmeal replacement	Increased crude protein and fat content in fingerlings; improved growth rates and protein utilization (Arshad et al.,2022).
Common Carp	upto 65% fishmeal replacement	Enhanced growth performance and superior feed utilization efficiency (Ozturuk et al.,2022).
Catfish	75%_100% fishmeal replacement	Boosted weight gain, survival rates, and immunity; use of BSF frass activates innate and adaptive immune genes. (Yildirim-Aksoy et al.,2024).
Atlantic Salmon	upto 10% BSFL meal inclusion	Maintained stable growth and welfare while improving skin mucosal health and hematological profiles (Biancarosa et al., 2023).
Rainbow Trout	Varying levels (BSF-based)	Improved overall health, growth, and specific enhancements to fillet quality (Ozturk et al., 2021).

waste into useful outputs under optimized conditions. This high bioconversion efficiency is supported by their specialized digestive system. This lets them process diverse substrates like food waste, livestock manure, and agricultural by-products. Even nutrient-deficient materials can be effectively utilized when supplemented appropriately. This highlights their adaptability.

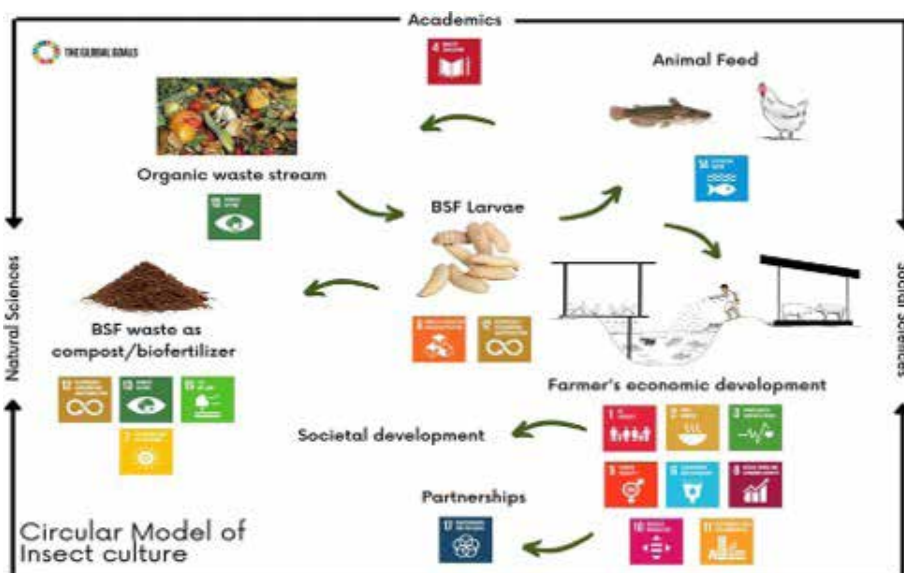
Furthermore, BSF systems help mitigate greenhouse gas emissions and reduce excess nutrient pollution, making them an important component of integrated waste management strategies. Life-cycle assessments consistently show that BSF-based waste treatment has a significantly lower global warming potential compared to conventional composting, reinforcing their role as a sustainable solution for waste management and feed production.

These findings clearly demonstrate that the inclusion of Black Soldier Fly meal is not only feasible across a wide range of species but also offers consistent improvements in growth, feed efficiency, and overall fish health.

The Future Outlook: BSF as a Sustainable Protein Backbone

Building on these promising results, the role of Black Soldier Fly (BSF) larvae extends beyond fish nutrition into broader climate resilience and economic sustainability. By efficiently upcycling organic waste, BSF farming reduces landfill burdens, cuts methane production, and lowers global warming potential—with studies showing waste treatment via BSF can reduce greenhouse gas

Turning Waste into Value: The BSF Advantage



Source: Gadzama et al., 2025

Invitation



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Kakinada, Andhra Pradesh, India

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7, 8 & 9 December 2026
Kakinada, A.P., India

Venue: SRMT Function Hall
Kosurivari Street, Kakinada, Andhra Pradesh, India

Exhibition Timings: 10 AM to 6 PM

Panel Discussion & Interaction Meet

Experts and Consultants in Aquaculture are invited to take part in Panel Discussion and answer to the queries and issues of the farmers during the meet on 7 December 2026

EXHIBITION • PANEL DISCUSSION

emissions up to 47 times compared to conventional composting. Furthermore, replacing up to 50% of traditional fishmeal with BSF larvae meal reduces carbon emissions by 30% while easing pressure on wild fish stocks and resource-intensive crops like soybeans. Because it requires significantly less land and water than traditional agriculture and yields nutrient-rich frass as a organic soil fertilizer, BSF farming provides a highly efficient, circular, and climate-resilient backbone for sustainable aquaculture.

Localizing the Circular Economy: Upcycling Kanyakumari's Bio-Resources

While the benefits of BSF are evident globally, their true impact is realized through local integration. Kanyakumari's unique agro-climatic conditions offer a rich source of diverse organic substrates. By localizing BSF production, we can upcycle regional agricultural by-products into high-value functional feed.

Current Status & Availability (2026)

The Black Soldier Fly (BSF) sector in Tamil Nadu has successfully transitioned from experimental research to emerging commercial scales, highlighted by major production hubs established in Chennai, Trichy, and Coimbatore that supply commercial de-oiled BSF meal to the B2B market at competitive rates. In a significant policy push in March 2026, the Tamil Nadu State Planning Commission officially recommended the adoption of BSF bioconversion technology in its report, 'Organic Waste Management in Urban Tamil Nadu', urging the government to launch pilot projects across Chennai, Coimbatore, Madurai, Trichy, and Salem. Commercial capacity is growing rapidly, with enterprises like KovalBSF in Coimbatore processing over 120 tons of organic waste per month to produce approximately 10,000 kg of biomass monthly. As of early 2026, market data indicates that de-oiled BSFL meal trades in the regional bulk market between ₹ 110 to ₹199 per kg,

while whole dried larvae trade around ₹700 to ₹1,750 per kg depending on processing quality. Meanwhile, at the district level in Kanyakumari, availability remains focused on decentralized, small-scale units where farmers and researchers primarily source starter kits from nearby hubs like Thiruvananthapuram, making the district's high volume of free, diverse organic substrates an ideal candidate for establishing localized, low-cost production units.

Regional Substrate Potential and Bioconversion Efficiency in Kanyakumari

The feasibility of black soldier fly (BSF) based aquaculture in Kanyakumari is driven by the rich diversity and high volume of local organic waste, with research showing that the district's fruit waste yields a superior Efficiency of Conversion of Digested feed (ECD) of 10.8% and a Waste Reduction Index (WRI) of 4.18 compared to general food waste (Karthikeyani et al., 2024). As a premier coconut-producing belt, the region provides abundant coconut by-products like coconut water and "oil cake" (poonac), from which BSF larvae efficiently process residual fats and fibers into high-quality biomass. Additionally, tropical fruit waste from Kanyakumari's famous bananas, pineapples, and jackfruits offers high sugars and carbohydrates that act as "fast fuel" for rapid larval growth and lipid production. The district's hilly tracts contribute abundant rubber seed cake, an underutilized resource that BSF larvae can safely detoxify and upgrade nutritionally, while areas like Vilavancode and Kalkulam supply cashew apple waste that provides crucial hydration and energy for BSF colonies. Finally, leveraging the active coastline of Muttom and Colachel, marine and fishery processing waste can be blended with these plant substrates to create a premium mixed diet, resulting in BSF larvae with enhanced omega-3 fatty acid profiles specifically tailored to boost local aquaculture.

Closing the Loop: The Frass Value

The circularity of this system extends beyond the larvae. Research on BSF

frass_ the larvae's excreta applied to Kanyakumari soils shows that a 15% inclusion rate significantly enhances plant height and chlorophyll content. This provides a secondary economic stream for the district's plantation sector, replacing synthetic fertilizers with nutrient-rich organic insect frass.

Conclusion:

Scaling the use of the Black Soldier Fly (BSF) as a sustainable protein source offers a practical solution to major challenges in aquaculture and waste management. Its unique ability to convert organic waste into high-quality protein not only reduces landfill burden and methane emissions but also creates valuable biomass for feed production. Compared to conventional protein sources, BSF farming requires significantly less land, water, and energy, making it a resource-efficient alternative. The processed larvae can be used in aquafeeds, animal feeds, and other applications, helping reduce dependence on fishmeal and soybean-based ingredients. By integrating waste recycling with feed production, BSF supports a circular and climate-resilient food system. As research, technology, and supportive regulations improve, BSF-based solutions will play an increasingly important sustainable aquaculture and global protein supply. BSF-based aquaculture systems represent not just an alternative, but a necessary transition toward climate-resilient, resource-efficient, and circular bioeconomy models.

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Some thoughts on low-cost major carp culture involving low-cost inputs

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Highlight Points

In this communication, I have given a brief description on few possible aspects of low-cost major carp culture activity appropriate to conditions of resource-poor fish farmers residing in far-away villages. Their contribution to our country's annual fish production cannot be underestimated. Many of these farmers sell a major portion of the harvested table-sized fishes in markets, rest is consumed at home with family members after cooking. I have gained some information in this regard after discussing with some elderly, progressive fish farmers in different districts of West Bengal. They have been benefitted from such low-cost but fruitful carp culture activities.

Introduction

In rural eastern India, scientific freshwater fish culture in earthen ponds has played a very significant role over the last fifty years towards affordable protein-rich food production, eradicating malnutrition-related health disorders, sustainable income and self-employment generation for youths and elderly farmers, and aqua-entrepreneurship development. Even protection of environment of large water bodies (as in 'East Kolkata Wetlands' and others) is secured via fish culture practice. Small and marginal fish farmers must be advocated to take up scientific freshwater aquaculture. They hold (own) small- to medium-sized pisciculture ponds, and contribute a considerable part

(amount) of the country's freshwater fish production every year, wrt to the Indian major carps. These people are not resource-rich, and some region-specific, farmer-friendly, low-cost but effective freshwater aquaculture technologies have been developed applicable and suitable to their condition, which will lead to their well-being, improved livelihood, increased fish production from their farm ponds and income. With commencement of monsoon every year, lakhs and lakhs of fish breeders and fish farmers produce major carp spawn in hatcheries, go for producing healthy, disease free, carp fingerlings and further good quality marketable-sized fishes in grow-out ponds, supply it to fish markets. Those in remote villages have adopted some low-cost approaches towards carp farming and its management, which minimizes expenditure, incurring low production cost and higher profit margin.

Supplementary feed for major carps

Formulated, pellet-type, industrially-manufactured supplementary feed have been produced for major carps in grow-out ponds by reputed companies and are available in market, having high protein content. But instead of buying it, small and marginal fish farmers in distant villages can prepare nutritionally-balanced, supplementary major carp feed at their farm site on their own. It may be in the form of floating pellets using hand or motor-operated pelletizer, or semi-cooked (semi-boiled) dough ball placed in slopy marginal area of ponds beneath water surface, or bag feeding method. They can go for either of the three feed formulations mentioned

here, to be applied @ 6-3% of total body weight of growing fingerlings and thereafter daily: 1st formulation (for every 1kg) mustard oil cake 300gm, rice bran 300gm, groundnut oil cake 150gm, pulverized fish meal 100gm, broken rice 50gm, wheat flour 90gm and Vitamin 10gm; 2nd formulation (in 100%) rice dust 38%, groundnut oil cake 35%, soyabean meal 20%, fish meal 3%, vegetable oil 1%, fish oil 1% and Vitamin-Mineral premix 2%; 3rd formulation (for every 100kg) groundnut oil cake 15kg, mustard oil cake 25kg, broken rice (boiled) 30kg, wheat flour by-product 5kg, maize dust 15kg, fish meal 8kg and Vit & Min mix 2kg. De-oiled rice bran may be used instead of rice bran ('dhaner kuro' or 'chaler kuro'), which is comparatively lower in price.

In every 100kg conventional mustard oil cake and rice bran mixture in equal amounts, amount of rice bran may be halved and 25kg maize dust may be included. Amount of mustard oil cake may be reduced, which is compensated by using same amount of ground nut oil cake. If farmers observe that fish meal is costly, then its amount may be reduced and soyabean meal may be used. Goat meat waste or poultry meat waste (left over) obtained from meat shops may be used as protein source, which is low in cost. In every 1kg of farm-made major carp feed, in addition to other ingredients, 5-7kg meat waste or meat meal, 5kg fish meal, and 30kg comprising three ingredients ground nut oil cake, mustard oil cake, soyabean meal will give a protein percentage of 30-35%. Raw chick pea ('chhola') or raw 'chana motor', both inferior in quality may be grinded and added to carp feed. Flattened rice



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('chira') may be used as one of the ingredients.

A low-cost formulated farm-made feed may also be prepared using rice bran, black gram (pulses) bran, wheat bran, mustard oil cake pulverized, flaxseed oil cake/linseed oil cake, fish meal, sugarcane molasses and Vit-Min mixture. A mixture comprising 25% wheat bran, 30% rice bran, 25% pulverized mustard oil cake, 10% fish meal and 10% wheat flour or sugarcane molasses will also serve as major carp feed. If de-oiled rice bran and mustard oil cake (1:1) is made to ferment for 3 days using probiotics bacteria and subsequently used, it serves as very good quality major carp feed low in cost. If the fish farmers are given knowledge and idea about Food Conversion Ratio, Daily Weight Attained, Daily Growth Rate Gained, Demand of Food for Indian major carps, Pangas catfish and other cultivable fishes in Fish culture training programmes by experts/trainers, then they will be able to apply feed in correct (proper) amount everyday, feed wastage will be minimized; they will be able to save money i.e. expenditure on fish feed prepared – their production cost (in order to produce every 1kg fish) will not rise and will be benefitted in the end.

Use of compost manure and grass carp faeces

Fish farmers in villages may get some low-cost and easily-available ingredients with less effort. These may be mixed for preparation of compost organic manure within 7-20 days in pits (4-6 feet deep) on pond periphery, which if periodically and routinely applied in major carp grow-out (composite) culture ponds will lead to increase in fish growth and production. Water is applied every 2-4 days interval during production process - both pond soil and water will become enriched with organic carbon, nitrogen, phosphorus, potassium, with increase in natural fish food matter for all kinds of major carps - surface, column and bottom feeders. Such items include cut pieces of green grass, green terrestrial creeper vegetable

leaves, inferior quality cabbage, vegetable peel-offs, pieces of raw water hyacinth (or burnt as ash), Pistia sp., submerged aquatic weeds, mustard oil cake, liquefied raw cow dung, thick & black pond silt sediment old in age, kitchen salt, little amount of limestone powder (optional, only if water hyacinth is used).

In every 33 decimal of grow-out pond, it requires a mixture of total 100-200kg of organic (biodegradable) food constituents that will lead to manure production. For every 1 quintal, the constituents green grass/green plant leaves 45kg, cow dung 50kg and mustard oil cake 5kg are required. Sundried poultry litter may be used in lower amount instead of cow dung. If 25nos of grass carp (250-500gm in weight) are stocked in every 33 decimal pond area, then organic fertilizer is naturally produced in water body where Indian major carps are under culture. If submerged aquatic weeds are absent in grow-out ponds, then everyday 10-20kg of green grass/green leaves/submerged aquatic weeds should be applied in pond from outside. It will be fed by grass carps, whose faecal matter (semi-digested excreta) will make the ponds highly productive. If grow out major carp culture ponds are stocked with fingerlings @ 400-500nos in every 25 decimal water area (4-5mt depth) with 40-50% comprising the exotic carp grass carp, then upto 300-400kg table fish may be produced from such a water body in a year, without the application of supplementary fish feed – only green leaves/green soft weeds are necessary for grass carp.

Fish farmers should continue stocking of big-sized 'stunted' fingerlings or yearlings (50-150gm; 5-6inch each) of Indian major carps in grow-out ponds from end of winter till end of autumn every year. From end of February, it has to be done after treating the ponds entirely with Mohua oil cake in proper dosage (or semi-decomposed Mohua oil cake). Supplementary feed should be applied every day and every month based on Demand of food. Burnt banana pseudostem (logs) ash or pieces of raw banana stem may

be successfully used to neutralize acidic condition in grow-out major carp culture ponds, which functions as agricultural lime. Once in a month or in fortnightly intervals, 8kg urea and 12kg single super phosphate may be mixed with the prepared organic manure and applied in fish ponds (every 33dec area) after liquefying the matter with water.

Careful use of poultry bird waste

Thick bed of litter obtained from houses of farmed poultry birds like White Leghorn and Rhode Island may be used in fish ponds very effectively after sun-drying. It contains a higher percentage of N, P and K in comparison to raw cow dung, contributes to increase in planktonic food matter in culture ponds. Sarangi and Sonali varieties of chicken have also come up which farmers may buy and use in poultry-cum-fish integrated farming system. Care must be taken so that wood dust (saw dust) and/or rice (paddy) husk is present in its most minimum quantity in the poultry litter.

Some fish farmers opine that if droppings (defecation) of poultry birds is directly allowed to fall down upon carp culture pond through copper wire meshed floor (having bamboo support) of poultry house act as cost-effective food of growing carps. It largely reduces the expenditure on buying commercially-available fish feed. But one must remember that this process is very risky. Raw poultry droppings can deteriorate pond water quality, water turns blackish, excessive phytoplankton production may take place which is unwanted, thick layer of black silt is formed over pond bottom, foul smell ejects due to production of obnoxious gases in pond, disease-causing microorganisms will multiply and fishes will be infected.

The litter contains faecal matter of poultry birds, uneaten feed meant for the birds, undigested feed excreted by the birds and saw dust. The 12-14 days old chicken can be stocked in poultry houses. In deep litter, each produced in 60-65 days period, with good bed management, hygienic



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litter that will be produced must be dried under sunlight, pathogens will be destroyed and farmers can apply it in ponds at proper dosage: 165kg in every 33 decimal pond (1.0-1.2mt depth) before carp fingerling stocking, and 50-55kg/33dec/month during post-stocking period in two installments. Poultry litter obtained from poultry houses constructed near pond may be processed and made to decompose under control using beneficial bacteria – after which it can be applied in ponds.

Application of poultry litter should only be intended to boost up phytoplankton and zooplankton production in grow-out ponds, not as fish food. Faeces of poultry birds is directly eaten by few species of major and medium carps but it should not be applied as food source. If poultry-cum-fish integrated farming is done cautiously, which does not require high investment, then growth of both fishes and poultry birds will occur simultaneously - farmers old and young in age in rural areas will be benefitted from this vocation with a highly satisfactory income after sale of adult ones of two profitable farm produce major carps and poultry bird, will reduce unemployment. Rural youths who have newly adopted carp farming in ponds may follow all the above-discussed aspects of low-cost major carp culture activity, involving much reduced costs in fish feed and inorganic fertilizers.



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Unlocking the Power of Kelp Forests: Exploring their Role in Blue Carbon

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Key points

Kelp forests are crucial underwater ecosystems that play a significant role in absorbing carbon dioxide, supporting biodiversity, and protecting coastlines. As part of the blue carbon system, their rapid growth enables them to capture large amounts of carbon, making them valuable in climate change mitigation. These ecosystems not only act as natural carbon sinks but also help reduce coastal erosion and sustain fisheries and industries. However, they face growing threats from overfishing, pollution, marine heatwaves, and invasive species like sea urchins, leading to significant declines in kelp coverage. To counter these challenges, restoration efforts such as kelp reforestation, sustainable fisheries management, and integrating kelp into carbon credit markets are being implemented. Preserving and restoring kelp forests is essential not only for climate action but also for maintaining ocean health, supporting coastal economies, and ensuring a sustainable future.

Abstract

Climate change is accelerating, posing significant threats to ecosystems, economies, and communities. Among nature-based solutions, kelp forests have emerged as a vital yet underappreciated tool for carbon sequestration and ecological restoration. These fast-growing underwater ecosystems play a crucial role in absorbing carbon dioxide, supporting marine biodiversity, protecting coastlines, and sustaining local economies. As a key component of “blue carbon”—the carbon captured by oceanic and coastal

ecosystems—kelp forests contribute to global climate mitigation efforts. Despite their importance, kelp forests face severe threats from ocean warming, pollution, overfishing, and invasive species, leading to drastic declines in some regions. However, innovative restoration efforts, sustainable fisheries management, and the integration of kelp into carbon credit markets offer hope for conservation. By investing in kelp forest restoration, governments, scientists, industries, and Indigenous communities can enhance climate resilience, protect marine ecosystems, and support sustainable coastal economies. Recognizing and safeguarding kelp forests as a crucial climate solution is essential for a healthier, more sustainable future.

Introduction

Climate change is accelerating at an unprecedented rate, posing significant threats to ecosystems, economies, and communities worldwide. In response, nature-based solutions have emerged as vital tools for reducing carbon emissions and restoring ecological balance. While forests and wetlands are often the focus of carbon sequestration efforts, an equally important yet frequently overlooked resource exists beneath the ocean’s surface: kelp forests. These underwater ecosystems play a crucial role in absorbing large amounts of carbon dioxide, supporting biodiversity, protecting coastlines, and sustaining local economies. The contribution of kelp forests to the global carbon cycle is increasingly recognized through their role in blue carbon—the carbon captured and stored by oceanic and

coastal ecosystems. As international efforts to mitigate climate change intensify, understanding the ecological and socio-economic significance of kelp forests has become more critical than ever. This understanding is essential for developing effective conservation strategies and harnessing the full potential of these ecosystems in the fight against climate change.

What are kelp forests?

Kelp forests are expansive underwater ecosystems composed of fast-growing brown algae belonging to the order Laminariales. Predominantly found in temperate and polar coastal regions, these marine forests form dense layers that serve as critical habitats for a wide range of marine species, including fish, sea otters, invertebrates, and seabirds. These ecosystems are essential not only for supporting marine biodiversity but also for sustaining coastal economies. Local communities depend on the fish and shellfish populations that thrive within kelp forests, while various industries benefit from the sustainable harvesting of seaweed for use in food products, pharmaceuticals, and biofuel production.

Blue carbon an ocean climate solution

Blue carbon refers to the carbon captured by ocean ecosystems such as mangroves, seagrasses, and kelp forests. Although kelp does not store carbon in sediments like mangroves, its rapid growth, which can reach up to 50 centimeters per day, allows it to absorb significant amounts of carbon dioxide from the

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atmosphere. When kelp detaches from the seafloor, some fragments drift into deeper ocean waters, where the carbon they contain can remain stored for centuries. Emerging research suggests that kelp forests may significantly contribute to global carbon sequestration, making them vital resources in addressing climate change. Emerging research indicates that kelp forests may significantly contribute to global carbon sequestration, making them vital resources in addressing climate change.

Importance of Kelp Forests in Climate Change Mitigation

- **Efficient Carbon Absorption:** Kelp forests absorb carbon dioxide more effectively than most terrestrial plants, offering significant potential for climate change mitigation.
- **Biodiversity Hubs:** These vibrant marine ecosystems provide habitat for hundreds of species, supporting rich biodiversity and sustaining fisheries that are vital for local economies.
- **Natural Coastal Protectors:** Kelp forests reduce wave energy, helping to prevent shoreline erosion and buffer coastal areas against storm surges, an increasingly important function as sea levels continue to rise.
- **Economic Opportunities:** Kelp cultivation presents sustainable economic opportunities for industries such as food production, cosmetics, pharmaceuticals, and biofuels, contributing to both environmental and financial resilience.

Threats to the Future of Kelp Forests

Despite their ecological and economic significance, kelp forests are facing severe threats. Overfishing, pollution, invasive species such as sea urchins, and ocean warming have contributed to widespread declines in kelp coverage. In regions like Northern California, as much as 95% of kelp forests have been lost, driven by the combined effects of marine heatwaves and the decline of natural

predators.

Solutions: Restoring Kelp Forest Ecosystems

Efforts to restore kelp forests are gaining momentum globally, with strategies that include:

- **Restoration Projects:** Initiatives such as The Nature Conservancy's kelp forest restoration programs focus on reforestation and invasive species removal.
- **Sustainable Fisheries Management:** Protecting keystone species like sea otters, which help regulate sea urchin populations, is essential for maintaining kelp.
- **Carbon Credit Integration:** Including kelp forests in carbon offset markets could incentivize conservation by providing financial support for restoration.

The Future of Blue Carbon

The potential of kelp forests to combat climate change extends beyond their function as carbon sinks; they play a crucial role in maintaining ocean health, supporting coastal economies, and preserving biodiversity. Realizing their full potential requires collaborative efforts among governments, Indigenous communities, scientists, and industries. Investing in kelp restoration not only contributes to climate change mitigation but also ensures a sustainable future for coastal communities around the world. In the global effort to address climate change, kelp forests stand as essential yet often overlooked allies deserving of greater recognition and support.

Conclusion

Kelp forests represent a powerful yet underappreciated natural solution in the fight against climate change. Their ability to absorb carbon dioxide, protect coastal ecosystems, support marine biodiversity, and provide economic opportunities highlights their multifaceted importance. However, the growing threats posed by climate change, pollution, and overexploitation demand urgent action to preserve and restore these vital ecosystems. Collaborative efforts among governments, scientists,

Indigenous communities, and industries are essential to unlock the full potential of kelp forests as a nature-based solution. By prioritizing their conservation and restoration, we can not only mitigate climate change but also promote healthier oceans, bolster coastal economies, and secure a more sustainable future for generations to come.

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