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# Aqua International

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July 2024

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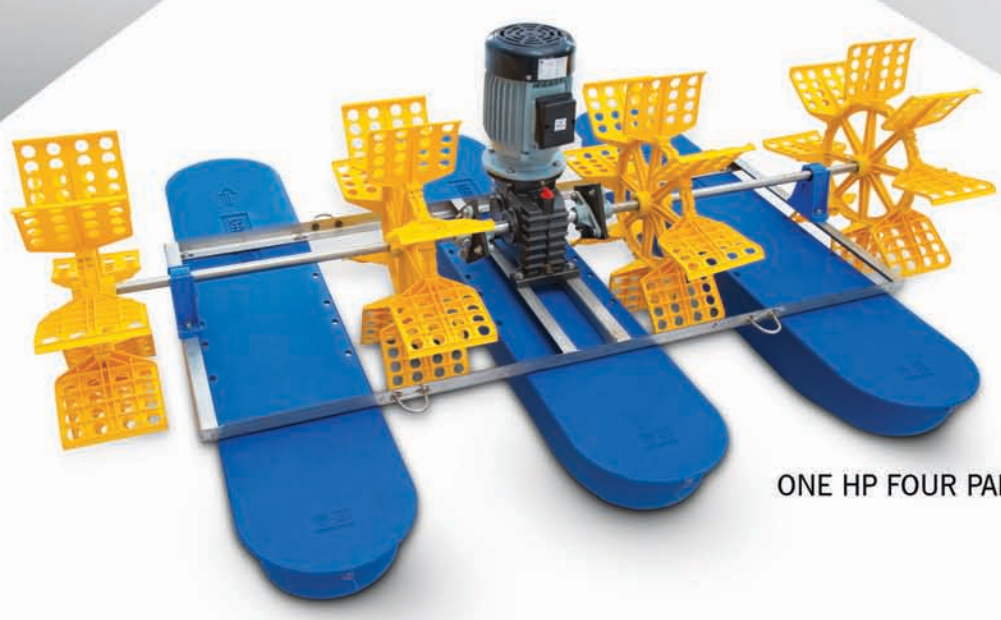

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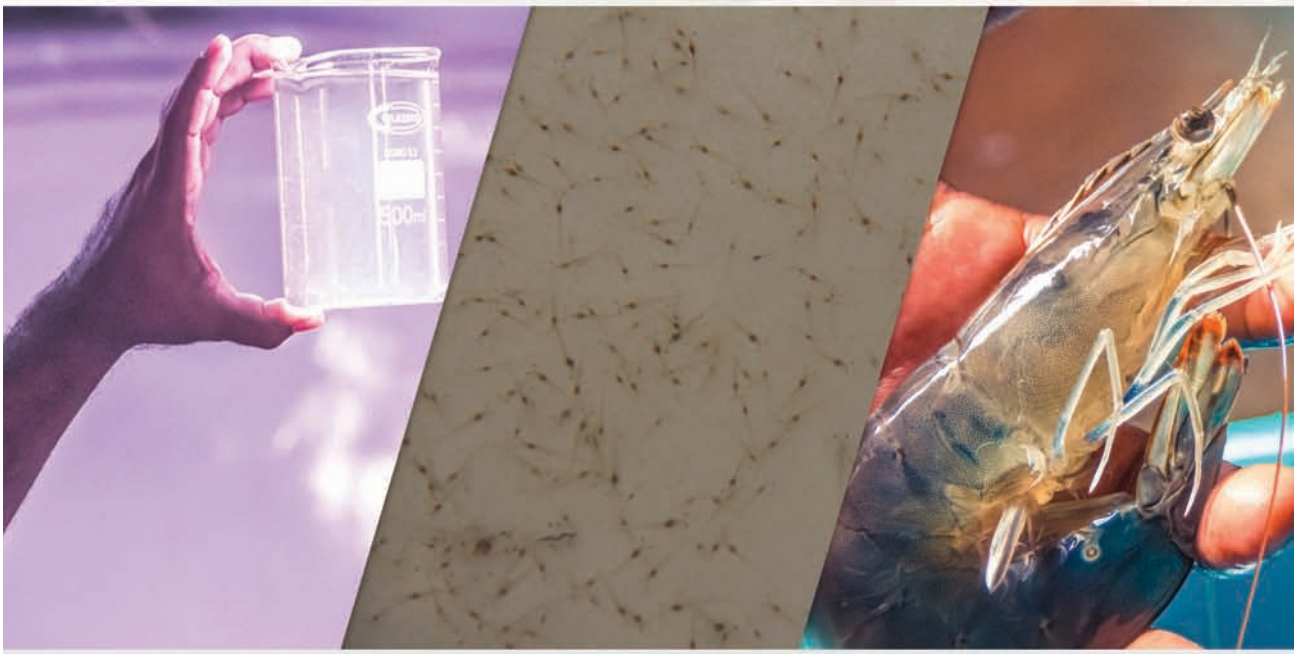

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- Editor



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# India exports 17,81,602 MT of seafood worth ₹60,523 crore during 2023-2024

## *Andhra Pradesh has contributed to a bulk of seafood exports at 32%*

*Expansion in fish farming is to management of aquacultural pond for the seepage control and this management is conceived as a potential thrust area towards building better environment for the persons living at gross root levels. In this widening perspective, an attempt is made here to comprehend the role, potential, requirements and package of practices for Seepage control in the Aquacultural ponds. Hence, the important aspects related with selection of an appropriate site and the remedial measures of seepage problem in fish farms.*

Dear Readers,

The July 2024 issue of Aqua International is in your hands. In the news section, you may find news about ...

**India exported 17,81,602 MT of seafood worth ₹60,523 crore during 2023-2024,** of which Andhra Pradesh has contributed to a bulk of seafood exports at 32%, announced MPEDA Chairman Mr D.V. Swamy. In 2022-23, India exported 17,35,286 MT of seafood worth 63,969.14 crore. Despite facing challenges in the global market, India's seafood exports touched an all-time high with marine products worth 7.38 billion US dollars shipped in the previous year (2023-24), he stated. Majority of share of exports went to the USA, China, European Union, South East Asia and the Middle East. Aquaculture farmers being trained in producing quality shrimp, value-added seafood products which enjoy a great demand in the overseas market.

**Andhra Pradesh topped** the list of states in fishing and aquaculture and accounts for 40.9% of the share in the sector followed by West Bengal, Odisha and Bihar. West Bengal's share in all India output has come down from 24.6% in 2011-12 to 14.4% in 2022-23 while Odisha and Bihar increased their share, according to a latest statistics office report on value of output from agriculture and allied sectors. The output of the fishing and aquaculture sub sector increased steadily from about Rs 80,000 crore in 2011-12 to about Rs 1,95,000 crore in 2022-2023. Output of marine fishing includes the entire output of prawn-inland or marine.

**Over 160 groups have signed** a letter to Dr Manuel Barange, head of fisheries at the FAO, to request that the farming of carnivorous fish – such as salmon, sea bream and sea bass – be excluded from its definition of "sustainable aquaculture". Environmentalists argue that farming fish that eat feeds containing other fish is not sustainable. The letter was organised by the Rauch Foundation and Eva Douzinas, its president, comments: "We live on a beautiful, blue planet and we want to celebrate life on World Ocean Day 8 June.

**Global aquaculture production reaches** unprecedented high global aquaculture and fisheries production has reached an all time high, with aquaculture exceeding fisheries productivity for the first recorded time, according to a new report form the FAO. World fisheries and aquaculture production has hit a new high, with animal aquaculture surpassing capture fisheries in terms of production for the first time, according to a recently released report from the Food and Agriculture Organization of the United Nations.

**Global aquafeed companies to test** krill replacements. In the wake of the F3 Krill Replacement Challenge, 5 prominent aquafeed companies have committed to testing the top products of the competition within their commercial operations. Five prominent international aquafeed companies have committed to testing the shortlisted products of the F3 Krill Replacement Challenge within their commercial operations, signalling a significant milestone for the future of fish feed and the wider aquaculture industry.

*Contd on next page*

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### *Our Mission*

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

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

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

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

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

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**Industry partnership aims to** advance seafood traceability. Aiming to support the widespread adoption of electronic traceability practices within the seafood industry, the Global Dialogue for Seafood Traceability has forged a new partnership with Fishwise. *Fishwise,* a seafood consultancy organisation and the Global Dialogue on Seafood Traceability (GDST), the industry standard for digitally interoperable traceability in seafood have forged a partnership to promote the widespread adoption of traceability best practices in seafood supply chains.

**The Sustainable Shrimp Partnership** has joined the Global Sustainable Seafood Initiative as an affiliated partner as part of a strategic move to promote improved practices within the shrimp industry. The Global Sustainable Seafood Initiative (GSSI), a public private partnership which aims to drive the seafood sector towards improved practices has announced a collaborative affiliation with the Sustainable Shrimp Partnership (SSP), a pre-competitive organisation based in Ecuador, which seeks to support the development of the shrimp industry.

**The Pengba *Osteobramabelangiri*** is a high valued medium carp endemic to North East India. It is a near threatened fish species, fetches good market price, has high consumer demand in this region. In the context of freshwater aquaculture for species diversification and conservation, it is a new potential candidate species. In the year 2018, Mr Sarat Chandra Bhowmick, a progressive and professional fish farmer and owner of Ganga Maa Hatchery at Village Basanchak, Block Haldia, District Purba Medinipur, West Bengal has initiated farming of Pengba fish for the first time in West Bengal on medium to large scale under the guidance of Dr P. C. Das, Principal Scientist, ICAR-CIFA. Since 2018, almost every year, he procures its fry (0.5 inch size) from ICAR-CIFA, Bhubaneswar and rears them in eastern ponds. In one year, it reaches 500-600gm.

**In the Articles Section, *Seepage Control Methods in Aquaculture Ponds,*** authored by Vivek Kumar, Abhishek Kumar, Dr Naresh Raj Keer, Dr Abhimaan and Rajkamal Mishra, discussed that the fisheries and aquaculture sector play very vital role in supplying protein rich food for developed and developing countries in the world especially. It is also important for different forms of development like employment generation, recreation and sporting, ornamental farming, area reclamation, resource conservation, ecological literacy enhancement, biomedical extraction and foreign exchange earnings, besides being major food suppliers toward food security and poverty alleviation. With the growing knowledge and demand, dimensions of fisheries and aquaculture expand rapidly. One such expansion in fish farming is to management of aquacultural pond for the seepage control and this management is conceived as a potential thrust area towards building better environment for the persons living at gross root levels. In this widening perspective, an attempt is made here to comprehend the role, potential, requirements and package of practices for Seepage control in the Aquacultural ponds. Hence the important aspects related with selection of an appropriate site and the remedial measures of seepage problem in fish farms are discussed in this article.

**Another Article titled, Blue Blood Crabs - A New Hope for Cancer Treatment,** authored by, Monalisha Mishra, J. Joshi Sharon, Tanupriya Bhakta, Priyanka Sinha, Debapriyo Mukherjee, Koel Bhattacharya Sanyal and Gadadhar Dash, stated that a new hope for cancer treatment horse shoe crabs are marine arthropods originated about 450 million years ago, existed nearly unchanged (looks exactly like their fossilized ancestors) well before even dinosaurs existed, hence called as living fossils. Its haemolymph contains a copper containing compound **haemocyanin** instead of haemoglobin which is responsible for the characteristic **blue colour** of their blood. Though they are called blue blood crabs due to the colour of their blood, they are not true crabs but instead are chelicerates, more closely related to spiders and scorpions. They got their name as Horse shoe crabs because of their arc shaped carapace, has been compared to the shape of a horse's shoe.

**Another article titled Abandoned Lost and Discarded Fishing Gears: The Threat they Pose to Marine Biodiversity,** authored by Shravan K Sharma, M P Remesan, Parasnath Jha, Abhay Kumar and Asha K K, said that the world's oceans are being polluted with a new type of plastic. This plastic is not the kind that you can recycle or use to make new products. It is the kind that has been discarded or lost and left to float in our oceans. This specific type of plastic pollution is called "ghost gear", and it is made up of discarded fishing nets, lines, buoys, traps and other fishing gear. These ghost gears are either lost at sea or thrown away by fishermen after they are done using them. Ghost gears come in all shapes and sizes, but they all have one thing in common, they are made from plastics such as polypropylene, nylon, polyester and PET (polyethylene terephthalate).

**Another article titled Assessment of Gender Roles in Small-scale culture-based sectors in Kerala,** authored by Thankam Theresa Paul, Arun Pandit, Vandana Das, Albin Albert C, Deepa Sudheesan, Manoharan S and B.K. Das, stated that India is the second largest producer of fish in the world, accounting for 8% of global production (FAO, 2022). The export of 5.95 billion USD in value signifies its contribution to fisheries trade globally (MPEDA 2021). Despite these significant contributions, our domestic people are affected by low fish availability, low protein intake, malnutrition etc. In this scenario, the Government of India identified aquaculture as a sunrise sector to meet our protein demand and export needs. In order to address critical gaps in fish productivity, technology, quality and modernise the fisheries sector, the central government has initiated an umbrella scheme (PMMSY, 2020). The scheme is proposed to increase the estimated aquaculture production of the country from 14.16 million tonnes (DOF, 2020) to 22 million MT by 2025. Doubling the income of farmers is also another target of PMMSY.

**Another article titled Sea Lily: A Lesser-known Marine Echinoderm,** authored by Rekha M. U, T. T. Ajith Kumar and Uttam Kumar Sarkar, discussed that Sea lilies, members of the Crinoidea class within echinoderms, boast an impressive lineage dating back 500 million years to the Ordovician period. Sea lilies are falls under echinoderms with 500 million years lineage. They are diverse in India waters with 86 species. They inhabit various depths with high biodiversity in West Pacific, Western Atlantic and North-eastern Atlantic. Sea lilies have calcareous skeletons with feather-like arms, adapting to different environments. They are filter feeders, aid in nutrient cycling and sediment stabilization. They face threats from deep-sea trawling and mining, necessitating conservation.

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# India exports 17,81,602 MT of seafood worth ₹60,523 crore during 2023-24

*A.P. is contributing to a bulk of seafood exports. Aqua farmers being trained in producing quality shrimp, value-added seafood products which enjoy a great demand in the overseas market.*

*Workers processing shrimp at a seafood export company.*

**Vijayawada:** The Marine Products Export Development Authority (MPEDA) has exported 17,81,602 metric tonnes of seafood worth ₹60,523 crore during 2023-24, of which Andhra Pradesh has contributed about 32%.

"Despite facing challenges in the global market, India's seafood exports touched an all-time high with marine products worth 7.38 billion US dollars shipped in the previous year

(2023-24)," said MPEDA Chairman Mr D.V. Swamy.

In 2022-23, India exported 17,35,286 MT of seafood worth 63,969.14 crore, he said.

"Export of frozen shrimp during 2023-24 was pegged at 7,16,004 MT. Farmers from Andhra Pradesh have contributed the majority of the share of exports to the USA, China, European Union, South east Asia and the Middle East," MPEDA Andhra Pradesh Region Joint Director, A. Jeyabal told The Hindu on Tuesday. Besides shrimp, other items such as frozen fish, squid, cuttle fish, octopus, lobster and dried fish were exported to Japan, Canada, Thailand, Belgium, Spain and other countries, the MPEDA Chairman said.

"US continues to be a major importer of Indian seafood with a share of 34.53% (worth 2,549.15 million USD), followed by China with 25.33% (valued at 1,384.89 million USD) and Japan at third with 6.06%. Frozen shrimp was the major item (33.26%) of exports shipped to Japan," Mr Swamy said.

Mr Jeyabal said that training was being conducted for the aqua farmers in producing quality shrimp and value-added seafood products which have great demand in the overseas market. "Value-added products will also generate employment in Andhra Pradesh. Recently, experts from Vietnam gave training to young entrepreneurs. We are focussing on conducting workshops in this regard," Mr Jeyabal said.

# Consumer knowledge of farmed salmon revealed

*As part of a Nofima project to develop sustainable feed for farmed salmon, focus groups have revealed a lack of knowledge amongst consumers about the fish they eat, as well as their natural diet.*

*Consumer knowledge of farmed salmon and their diets was low*

Currently, the salmon industry requires a greater diversity in sustainable raw materials which are beneficial to both salmon and the environment than current options, and microalgae and insects are promising raw materials. As part of a current project aimed at creating sustainable salmon feed from algae and insect meal, Nofima senior researcher Katerina Kousoulaki has been listening in on consumer focus groups to gauge the public's understanding of farmed salmon and their diets.

"The respondents loved eating salmon but did not know much about

Uni-President

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## 1. WATER QUALITY CONDITIONING

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## 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

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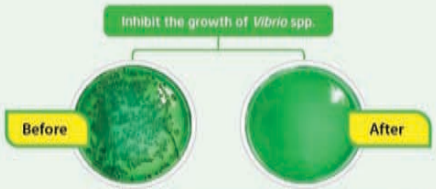
Compete nutrition with vibrio and inhibit them to grow. Provide nutrition for probiotics in the pond, to establish a well-balanced farming system.




## 6. INCREASE AQUACULTURE PRODUCTION

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

## * COMPOSITION:

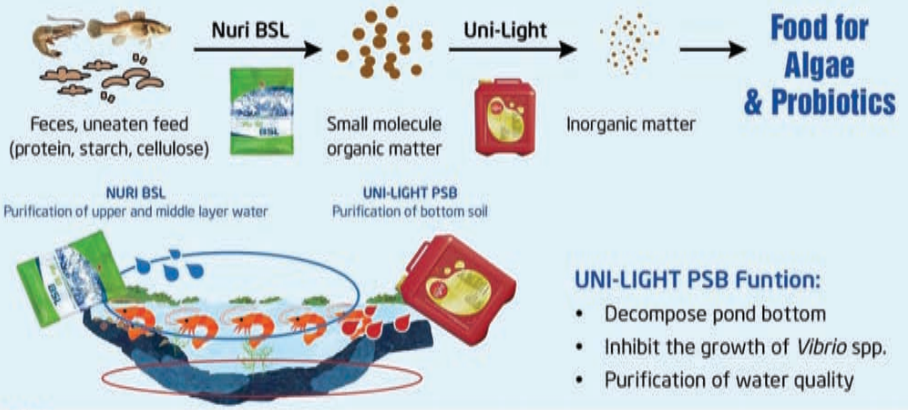
| | |
|---|---|
| *Bacillus* spp. > 1x $10^{11}$ cfu/kg | 15% |
| *(Bacillus subtilis, Bacillus amyloliquefaciens, Bacillus licheniformis)* | |
| Carrier (rice bran, corn gluten) | 75% |
| Moisture | 10% |


## * STORAGE:

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

## * DIRECTION OF USE:

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




### UNI-LIGHT PSB Funtion:

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

### BSL Dosage:

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| 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 |

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the fish. My impression is that we need to educate the consumers," said Kousoulaki, in a press release.

The focus groups revealed that the consumers actually knew very little about the fish that they were consuming and, in fact, presented several points which turned out to be false.

"If you ask people what salmon eat in the wild, many will answer 'algae' and 'shrimp'. However, salmon don't eat algae, and they don't eat much shrimp, either. They mainly feed on fish, and upriver they feed on insects. Many of the surveyed consumers had a positive attitude towards using algae in fish feed, but did not think that insects were a natural food for the salmon," Kousoulaki explained.

Market expert Sandra Bretagne is a leading partner in the consulting company Insightquest, which conducted the consumer survey using focus groups on behalf of Nofima and Auchan. She is confident that it is possible for consumers to accept salmon being fed more insects and algae - but believes that it will take time and focussed communication efforts.

"We need to start the communication on a very basic level. Consumers have little knowledge about industrial processes. Do you know anything about the industrial processes behind the production of shampoo? Very few do. And that's how it is with the food people eat, too - they tend to have only very superficial knowledge," she explained.

***Courtesy: The Fish Site.***

# Big Fish: Andhra dishes out 41% of India's aquaculture output

*Milk, Meat, Egg Output Up In '22-'23, Banana Is New King Of Fruits: NSO*

New Delhi: Andhra Pradesh topped the list of states in fish- ing and aquaculture and accounts for 40.9% of the share in the sector followed by West Bengal, Odisha and Bihar.

West Bengal's share in all India output has come down from 24.6% in 2011-12 to 14.4% in 2022-23 while Odisha and Bihar increased their share, according to a latest statistics office report on value of output from agriculture and allied sectors.

The output of the fishing and aquaculture sub-sector in- creased steadily from about Rs 80,000 crore in 2011-12 to about Rs 1,95,000 crore in 2022-23. Output of marine fishing includes the entire output of prawn- inland or marine.

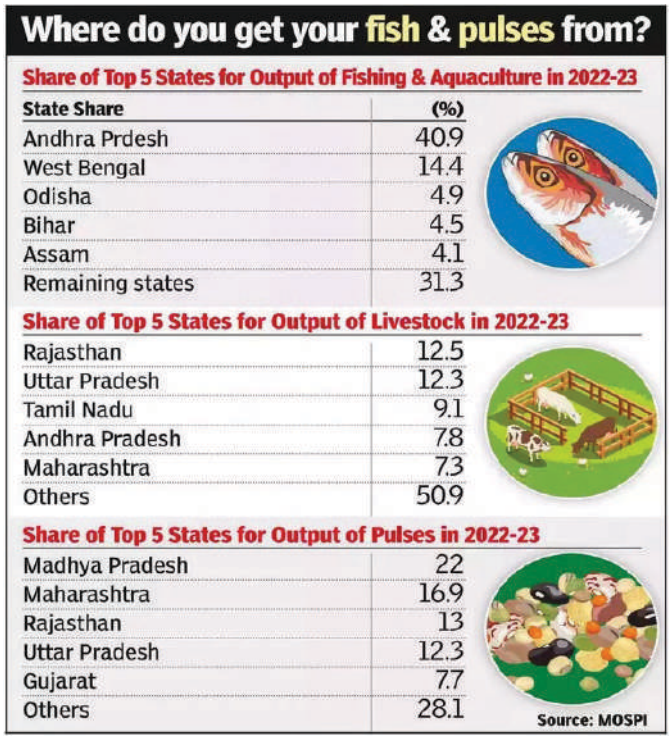
The output of the 'live- stock' sub-sector increased steadily between 2011-12 to 2022-23. During this period, the output of milk, meat and eggs also recorded an in- creasing trend.

The share of milk, meat and eggs in output of live- stock sub-sector was 66.5%, 23.6% and 3.7% respectively in 2022-23, compared to 67.2%, 19.7% and 3.4% respectively in the base year 2011-12, the data showed.

Uttar Pradesh and Rajasthan together accounted for about a quarter of output of livestock sub-sector while out- put of Tamil Nadu increased faster during this period. Uttar Pradesh had nearly 41% share of output of the sugar group in 2011-12, which increased to more than half of all India output of sugar crops in 2022-23. Maharashtra was distant second with 19%, followed by Karnataka at 8.9%, Tamil Nadu at 3.9%, Bihar 3.3%. The remaining states accounted for 11.4% When it comes to fruits, bananas overtook mangoes in terms of value of output in 2022-23. Banana had a share of 10.9%, followed by mango at 10%. Together, it accounted for more than one fifth of output of the entire group. Among the vegetables during 2022-23, potato and onion together contributed highest production, accounting for about 15% output of the group. Floriculture accounted for about 7%.

The data showed that agriculture, forestry and fishing accounted for 18.2% of the gross value added - a key indicator of economic performance-at current prices in 2022-23. After reaching 20.4% in 2020-21, it came down to 18.9% in 2021-22.

India ranks second world- wide in arable land (155.37 mil- lion hectares); third in production of cereals; and second in groundnut, fruits, vegetables, sugarcane, tea, and jute. The country had the largest herds of buffalo and goat; sec- ond largest in cattle and sheep; and seventh in chicken population in the world, as per the latest available informa- tion of 2020. It is the largest producer of milk; second in production of eggs and fifth in production of meat.



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# FAO pressured to remove "sustainable" label from farmed salmon and sea bream

*Over 160 groups have signed a letter to Dr Manuel Barange, head of fisheries at the FAO, to request that the farming of carnivorous fish – such as salmon, sea bream and sea bass – be excluded from its definition of "sustainable aquaculture".*

*Sea bream are widely farmed in the Mediterranean*

Environmentalists argue that farming fish that eat feeds containing other fish is not sustainable

The letter was organised by the Rauch Foundation and Eva Douzinas, its president, comments: "We live on a beautiful, blue planet and we want to celebrate life on World Ocean Day [8 June]. Instead, we are witnessing destruction of sea meadows, ecosystems, local fisheries, and livelihoods from the world's fastest growing food industry. There is a dire need to differentiate what is sustainable aquaculture, like seaweed or small scale bivalve farming, versus what is destructive. Fish farming of carnivorous species such as salmon, sea bream and sea bass (branzino) is proven to be wholly unsustainable. It is an industry that depletes the world's wild fish stocks and destroys marine ecosystems, not sustains them."

Despite escalating concerns, the signatories to the letter observe that FAO is aiming for 75 percent growth in global sustainable aquaculture by 2040 compared to 2020. Equally, they point out that the EU has given €1.2 billion to aquaculture since 2014, "allowing for the majority of the funds to go to growing destructive marine-based open net carnivorous fish farms, such as those in Spain, Italy and Greece".

Catalina Cendoya, director at Global Salmon Farming Resistance, based in Argentina, and co-organiser of the letter to the FAO, adds: "Industrial fish farms are highly polluting due to the vast quantities of faeces and waste generated, which create dead zones around the nets. The layers of slime below the pens can be 2m deep. Regulation has not kept up with aquaculture's gold rush on industrial fish farming. The FAO must stop labelling this destructive activity as 'sustainable'."

The signatories of the letter are determined to press the FAO to explain how they can consider carnivorous fish farms as sustainable, citing their belief that the industry accounts for a growing percentage of global antibiotic use and uses chemicals to control disease and parasites.

They also note that carnivorous fish farming consumes more wild fish than is produced, leading to "an unethical transfer of nutrients from the Global South, where small fish are converted into fish feed for carnivorous fish eaten in industrialised nations"

Other causes of complaint include the eutrophication of waters near farms, due to excess nutrient compounds from fish faeces and waste food, the escape of farmed fish and damage to benthic habitats such as Posidonia meadows, which are 35 percent more efficient than rainforests at removing carbon from the atmosphere.

"Let's make 2024 the year that the United Nations Food and Agriculture Organisation and the European Union step in to ensure that future generations can enjoy the beauty and richness of our ocean! We urge people everywhere to get informed, sign the petition to keep 'Fish Farms Out!', and stop buying farmed fish," concludes Cendoya.

***Courtesy: The Fish Site.***

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# Global aquaculture production reaches unprecedented high

*Global aquaculture and fisheries production has reached an all time high, with aquaculture exceeding fisheries productivity for the first recorded time, according to a new report form the FAO.*

*Animal aquaculture exceeded capture fisheries production for the first recorded time*

World fisheries and aquaculture production has hit a new high, with animal aquaculture surpassing capture fisheries in terms of production for the first time, according to a recently released report from the Food and Agriculture Organization of the United Nations (FAO).

The 2024 edition of The State of World Fisheries and Aquaculture (SOFIA) reports that global fisheries and aquaculture production in 2022 surged to 223.2 million tonnes, a 4.4 percent increase from the year 2020. This production comprised 185.4 million tonnes of aquatic animals and 37.8 million tonnes of algae.

Global aquaculture production reached an unprecedented 130.9 million tonnes, of which 94.4 million tonnes are aquatic animals - 51 percent of the total aquatic animal production. The report states that a comparatively small number of countries dominate the figures regarding this booming aquaculture production. Only ten countries - China, Indonesia, India, Viet Nam, Bangladesh, the Philippines, Republic of Korea, Norway, Egypt, and Chile -produced over 89.8 percent of the total.

Whilst aquaculture production rises, the FAO report states that global fisheries production remains largely stable. However, the proportion of marine fish populations fished within biologically sustainable levels followed previous trends of decline, dropping to 62.3 percent in 2021 – 2.3 percent lower than in 2019. This underscores the effect of sustained landing rates amidst the decline or instability of some commercially fished species.

"FAO welcomes the significant achievements thus far, but further transformative and adaptive actions are needed to strengthen the efficiency, inclusiveness, resilience and sustainability of aquatic food systems and consolidate their role in addressing food insecurity, poverty alleviation and sustainable governance," said FAO director-general Qu Dongyu, in a press release announcing the report.

In addition to analysis of fisheries and aquaculture production, the FAO report estimated the future trends of seafood consumption, projecting that annual per capita consumption will increase by 12 percent to over 21 kilograms by 2032. The projected increase is regional, however, as the FAO projects that aquatic food production in sub-Saharan Africa will not be able to increase in line with the growing demand, which may cause significant issues regarding nutrition and health for the countries of this region.

The continued growth of the seafood sector may lead to increased employment opportunities globally. However, the SOFIA report indicates that issues within this aspect of the seafood sector remain. Sex-disaggregated data indicated that women made up 24 percent of the overall workforce but 62 percent in the processing subsector. The report states that gender inequality issues, including differences in wages, insufficient recognition of women's contribution to the sector, and gender-based violence still persist in the global industry.

***Courtesy: The Fish Site.***

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# Global aquafeed companies to test krill replacements

*In the wake of the F3 Krill Replacement Challenge, 5 prominent aquafeed companies have committed to testing the top products of the competition within their commercial operations.*

*The F3 Krill Replacement Challenge aims to stimulate innovation within the aquafeed industry*

Five prominent international aquafeed companies have committed to testing the shortlisted products of the F3 Krill Replacement Challenge within their commercial operations, signalling a significant milestone for the future of fish feed and the wider aquaculture industry. The companies committed to testing the alternative feed ingredients during the 2024 F3 - Future of Fish Feed meeting in San Francisco.

F3 - the organisation behind the Krill Replacement Challenge - was founded on the premise that there are not enough fish in the ocean to feed our growing world population and that new aquaculture feed ingredients are necessary to ensure a food secure future and healthy ocean. The finalists of this year's competition include single-cell protein feed company Calysseo; Finland-based eniferBio, which produces fungi-based aquafeed; and India-based Shaivaa Algaetech, which use algae to create nutritious feeds.

Among the companies committed to testing these alternative feed ingredients are BioMar Group - a leading global supplier of feeds for salmonids, tilapia, and shrimp; Aller-Aqua - a family owned company which produces over 250,000 tonnes of feed annually; and

Aqquuaa - a company specialising in feeds for over 30 species of marine fish.

"We commend these companies for recognising the importance of finding alternatives to krill to ensure global food security and protect ocean health," said Kevin Fitzsimmons, chairperson for F3, in a press announcement.

"Their pledges underscore the dedication to innovation and collaboration that was nurtured at our meeting in San Francisco this week, aimed at promoting sustainable ingredients that enhance global food security and safeguard ocean and planetary health," he added.

The winners of the F3 Krill Replacement Challenge will be announced in early 2025.

***Courtesy: The Fish Site***

*A.N.V. Prasad, Treasure, Andhra Pradesh Aqua Dealers Welfare Association and Proprietor, Sri Lakshmi Aqua Care, celebrated his Birthday on June 19 at Bhimavaram. By coincidence, Aqua International Editor M.A. Nazeer was present there and greeted Prasad.*


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Folic Acid - 10 mg.
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LDLP - 15mg.
USFA - 5 mg.
APF - 30 mg.
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# Industry partnership aims to advance seafood traceability

*Aiming to support the widespread adoption of electronic traceability practices within the seafood industry, the Global Dialogue for Seafood Traceability has forged a new partnership with Fishwise.*

*The industry partnership aims to support the adoption of a seafood traceability standard*

Fishwise - a seafood consultancy organisation - and the Global Dialogue on Seafood Traceability (GDST) - the industry standard for digitally interoperable traceability in seafood - have forged a partnership to promote the widespread adoption of traceability best practices in seafood supply chains.

The newly announced partnership aims to promote the implementation of interoperable, digitised traceability systems and the adoption of the GDST standard across public and private sectors.

This collaboration could empower regulators and governments to support more standardised, transparent, and responsible seafood supply chains.

"Standardising data formats in both the public and private sector, and making electronic information sharing more seamless between traceability systems is crucial, not only for meeting companies' responsible seafood programs, but also for regulatory compliance and better governance," said Sara Lewis, programmes director at Fishwise, in a press release.

The GDST standard was created by civil society and industry, but voted into practice solely by industry stakeholders, and is now considered by some to be the industry standard for seafood traceability. The GDST Foundation works to expand the adoption of the standard and evolve it through a multi-stakeholder dialogue process. FishWise, for its part, focusses on implementing traceability best practices by verifying data, assessing risks, and developing due diligence programmes with seafood businesses, governments, and NGOs worldwide.

"Our new partnership with Fishwise will allow us to make advances in the adoption and evolution of the Standard," said GDST executive director Greg Brown.

"FishWise's deep involvement with its partners plus its collaborative and consultative approach with multiple stakeholders coupled with the GDST's Standard and technical resources will bring traceability into many conversations and assist the industry and regulators in meaningfully adopting digital interoperable traceability in seafood," he added.

***Courtesy: The Fish Site***


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**COMPOSITION:**
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BACILLUS SUBTILIS
BACILLUS POLYMIXA
BACILLUS LICHENIFORMIS
NITRASOMONAS
NITROBACTOR
STABILIZERS

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

**PRESENTATION:** 500 gms &1 kg


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# Sustainable Shrimp Partnership joins Global Sustainable Seafood Initiative

*The Sustainable Shrimp Partnership has joined the Global Sustainable Seafood Initiative as an affiliated partner as part of a strategic move to promote improved practices within the shrimp industry.*


*The affiliation marks a significant milestone for both organisations*

The Global Sustainable Seafood Initiative (GSSI) – a public-private partnership which aims to drive the seafood sector towards improved practices – has announced a collaborative affiliation with the Sustainable Shrimp Partnership (SSP) – a pre-competitive organisation based in Ecuador, which seeks to support the development of the shrimp industry.

"We are thrilled to welcome the Sustainable Shrimp Partnership to GSSI. The inclusion of SSP marks a significant milestone in our shared mission to advance the sustainable seafood movement - with a focus on the farmed shrimp sector," said Øyvind Ihle, GSSI chief executive, in a press release.

By joining forces, we can elevate industry standards, inspire broader participation in the pursuit of sustainability, and increase access to sustainable seafood for all," he added.

Announced this week, the strategic partnership seeks to accelerate the development of improved practices within the seafood industry, with a particular focus on the farmed shrimp sector. Both GSSI and SSP have stated their dedication to promoting responsible practices, ensuring the long-term viability of marine resources, and safeguarding people and ecosystems.

"Working hand in hand with GSSI allows us to expand the reach of Ecuadorian shrimp producers' efforts to address global sustainability challenges and continually raise the sector's sustainability standards. We're excited about this collaboration, and confident that we'll develop pathways for improvement in shrimp production and identify solutions and projects to advance proactively," said Pamela Nath, director of the SSP.

***Courtesy: The Fish Site***

# India's seafood exports reach record high in volume, but decline value

Despite achieving an all-time high volume, India's seafood exports saw a 5.38% decline in value, dropping to Rs 60,523.89 crore during the financial year 2023-24 from Rs 63,969.14 crore in the previous year. In dollar terms, the exports fell by 8.77%, from $8.09 billion to $7.38 billion.

India shipped 17,81,602 metric tons (MT) of seafood in 2023-24, with frozen shrimp remaining the major export item by both quantity and value. The USA and China emerged as the largest importers of India's seafood, according to an official release.

Frozen shrimp earned Rs 40,013.54 crore ($4.88 billion), maintaining its position as the top item in the seafood export basket. It accounted for 40.19% of the quantity and 66.12% of total dollar earnings. The export of frozen shrimp increased by 0.69% in quantity, totaling 7,16,004 MT. The USA imported the most frozen shrimp (2,97,571 MT), followed by China (1,48,483 MT).

The export of black tiger (BT) shrimp saw significant growth, with a 24.91% increase in quantity, 11.33% in value, and 8.28% in dollar terms. BT shrimp exports reached 38,987 MT worth Rs 2,855.27 crore ($347.84 million). China was the major export destination for BT shrimp, followed by the USA, the European Union, and Japan.

Other significant export items included frozen fish, which fetched Rs 5,509.69 crore ($671.17 million), and fish and shrimp meal, earning Rs 3,684.79 crore ($449.17 million). Frozen squid and surimi also contributed notably to the export earnings.

The USA continued to be the major importer of Indian seafood in value terms, with imports worth $2,549.15 million, accounting for a 34.53% share in dollar value. China followed as the second-largest market, importing seafood worth $1,384.89 million.

Despite the decline in export value, the increase in export volume highlights India's growing prominence in the global seafood market.

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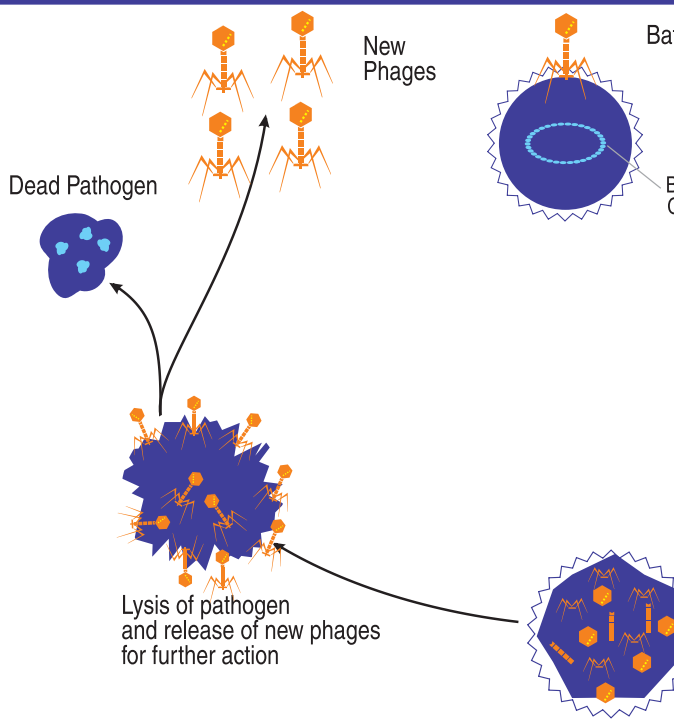


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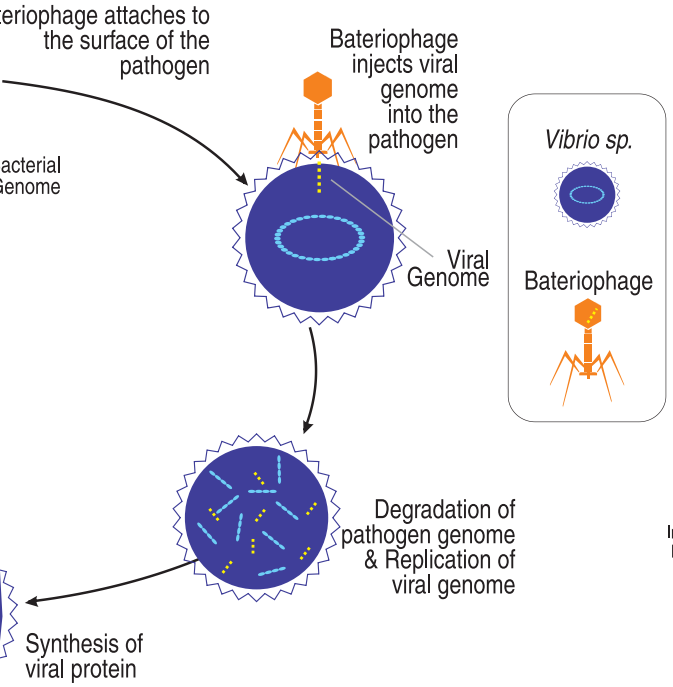


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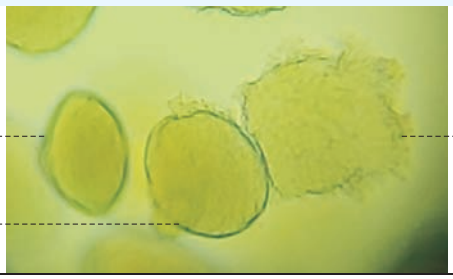
Stages of *Vibrio sp.* colonies infected with Bacteriophages & Progressive Lysis observed on an Agar plate, under Stereo Microscope

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

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



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

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# AQUA 2024 – Copenhagen is the place to be end August!

The AQUA events are co-organised by the European Aquaculture Society (EAS) and the World Aquaculture Society (WAS) and are held every six years. Past events were held in Nice (2000), Florence (2006), Prague (2012) and Montpellier (2018).

*Dag_Sletmo*

AQUA 2024 will take place from August 26-30 at the BELLA ARENA in the Danish capital of Copenhagen. It will comprise a scientific conference, trade exhibition, industry forums, workshops, student events and receptions. The event will highlight the latest aquaculture research and innovation to underpin continued growth of this exciting food production sector. It will be a showcase for Denmark, and its innovation leadership in several key technologies crucial for future aquaculture, but also a meeting and exchange platform for experts from around the world.

**The overarching theme of AQUA 2024 is BLUE FOOD, GREEN SOLUTIONS** and the scientific conference will include more than 60 sessions covering all aspects of aquaculture research.

AQUA 2024 has been organised with the support of our local partners, the Danish Export Association Fish Tech, ICES, DTU AQUA, the University of Copenhagen, EUROFISH and the Copenhagen Convention Bureau.

We are also extremely grateful for the support of our event sponsors, with GOLD SPONSOR BIOMAR, SILVER SPONSORS BIORIGIN, US SOY, UNIVERSITY OF STAVANGER and the BLUE PALNET ACADEMY and with SESSION SPONSORS AQUASOJA.

It is definitely the place to be at the end of August!

Key figures:

- Expected conference delegates: 1400
- Total expected participation: 2500
- No. of countries: 90
- Conference sessions: 60
- Special sessions, industry forums and workshops: 12
- Tradeshow booths: 240
- Tradeshow visitors: 1200

**Programme highlights**
It shows the parallel abstract-based scientific sessions, as well as the forums and special sessions that will take place and specifically targeted towards operators and producers. More on these below….

**Plenary speakers**
To put some general highlights to the conference theme, we have two exciting plenary sessions and speakers. On Tuesday, August 27th (09h00 to 09h40), Dag Sletmo, Senior Vice President Seafood Division, DNB will give an opening plenary "Analysing the Future."

FAO says we need to increase sustainable aquaculture production by at least 75% by 2040 if we are going to limit global warming to 1.5C. Dag will share his top-down financial perspective on what it will take to grow aquaculture production significantly. The demand drivers are in place, the challenge is increasing supply and at the same time reduce the environmental footprint. That will require new technology, better farming practises, and better regulations. As an industry depending very much on government regulations, it also needs a strong social license in order to achieve these goals. And where will the money to finance this come from? DNB Bank's aquaculture activities is very focused on salmon, but Dag will also address aquaculture more generally.

*Dag Sletmo is a Senior Vice President in the seafood division in DNB. DNB is the leading bank in Norway and the largest bank globally in salmon farming with clients in Norway, Faroe Islands, Iceland, Scotland, Canada, Chile and Australia.*

*Prior to joining DNB, Dag worked in Cermaq, the global salmon farmer, and ABG Sundal Collier, a Nordic investment bank. He holds an MBA from Columbia Business School in New York and has studied economics and philosophy at NHH and UiB in Bergen.*

*Signe Riemer-Sørensen*

**And end the end of conference, on Friday, August 30th (11h30 to 12h15), Signe Riemer-Sørensen Research Manager Analytics and AI, SINTEF will give her views on "AI with Knowledge."**

Large language models have democratized AI. Co-pilots and chat-bots are changing most office jobs, but despite their impact, they will not revolutionize aquaculture. For that we need completely different types of AI. Through examples from aquaculture and beyond, Signe will explain the challenges, provide intuitive insights into AI, and introduce the latest developments on industrial AI and their potential in aquaculture.

*Signe Riemer-Sørensen is Senior Researcher and Research Manager for*


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*Analytics and AI in SINTEF. Her research evolves around overcoming challenges for implementing machine learning and artificial intelligence in a broad range of industrial settings where physics plays a role and data is often sparse and noisy. The solutions integrate domain knowledge into the AI, in so-called hybrid AI, fostering robust, explainable and trustworthy models.*

This final plenary will be followed by the AQUA 2024 Poster Awards, overseen by the AQUA 2024 Programme co-chairs, Luisa Valente (CIIMAR, Portugal), Lorenzo Juarez (WAS, USA), Kjell Maroni (FHF? Norway) and Anne Cooper (ICES, Denmark).

**Industry and Innovation Forums**

A regular feature of EAS events is the Industry Forum and the Innovation Forum and these will take place during AQUA 2024.

**The Industry Forum will be held all day on Tuesday, August 27** and will address the main event theme, with key questions about the status and future of the sector with regards, to adaptation to climate change, mitigation of its effects, circular approaches and other externalities.

It will be divided into several panel discussions, overseen by our master of ceremony for the day, Lise Walbom, CEO, Food Nation Denmark.

The AQUA 2024 Innovation Forum is being co-organised by EAS, EATiP (European Aquaculture Technology and Innovation Platform) and the European Commission.

**It will be held all day on Wednesday, August 28th and will take the tile "Exploring Inter-Regional Collaboration & Innovation Transfer vehicles for Aquaculture."**

The Forum will explore inter-regional collaboration for innovation transfer through the lens of EU policy and initiatives, but also at the global level. It comprises four sessions with a lix of presentation and interactive discussion to address key questions.

- Session 1: European Aspirations for Inter-Regional Innovation transfer

*To address: Developing a Sustainable European Aquaculture to 2030.*

- Session 2: Inter-Regional Innovation Landscape in Practice: case studies on how innovation transfer vehicles promote advances in aquaculture :

*To address: Session 1 considered policy intentions and aspirations. But how is this actually being delivered on the ground and in reality? Examples will be presented.*

- Session 3: Innovation transfer within the aquaculture research community

*To address: Academic and research networks lend themselves intrinsically to international innovation transfer, with existing well networked stakeholders and organisations operating at the European and international level.*

- Session 4 – Facilitation, Funding models and future calls for inter-regional innovation transfer.

*To address: Innovation transfer works well as a concept, but how do we fund and facilitate this work? Resourcing is challenging, but funding options do exist. Examples such as the Mentoring and Accelerator Programme for Blue Grown, along with initiatives supported by the ECBF and BlueBio Alliance, demonstrate the innovation transfer infrastructures supporting the sector.*

The detailed programmes for both forums are currently being finalised and will be online at the events website in early July. https://www.aquaeas.org/

**Special sessions**

We also have several special sessions at AQUA 2024, bridging the gap between science and industry:

- Quantitative Atlantic Salmon Health Assessment
- EUROshrimp Forum
- Aquaculture Stewardship Council workshop on "Future aquafeed supply chains in a transitioning industry and a changing climate".
- Host Resistance to Sea Lice
- Light and Fish – And Light and other organisms
- IMTA and low-trophic aquaculture.

As above, the detailed programmes of these sessions will be online at the events website in July.

**Exhibition**

The AQUA 2024 exhibition is just about sold out, with more than 240 booths from suppliers and operators covering all aspects of aquaculture production at the global level. All coffee breaks and happy hours will be held in the exhibition hall to maximise interaction and some 1400 trade show visitors are expected.

**Tours**

On the Monday preceding the event, we have organised several tours.

AQ24 A_DTU: Tour high-tech facilities at the Danish Technical University (DTU) National Food Institute – side streams and research into new ingredients from marine raw materials. Monday, August 26. Morning. Cost: €25 per person. Maximum 30 persons.

AQ24 B_OXYGUARD: Visit OxyGuard International's Danish Headquarters. Monday, August 26. Morning. Cost: €25 per person. Maximum 30 persons.

AQ24 C_MAREL: A visit to the MAREL Progress Point global Demo Center, to see cutting-edge solutions and software for fish processing. Monday, August 26. Morning. Cost: €25 per person. Maximum 50 persons.

AQ24 D_AQUARIUM: A behind the scenes tour of the Danish National Aquarium (Den Blå Planet) - Northern Europe's largest aquarium. Monday, August 26. Afternoon. Cost: €60 per person. Maximum 50 persons.

Factsheets on all tours are available on the "Travel" top menu of https://www.aquaeas.org/ and registrants can sign up for them during the registration process.

**Registration link**

Early Bird registration for AQUA 2024 is at https://www.aquaeas.org/Registration/Submit/AQUA24E

But hurry, the deadline for the cheapest registration rates is July 1.

EAS and WAS both look forward very much to welcoming you to AQUA 2024!

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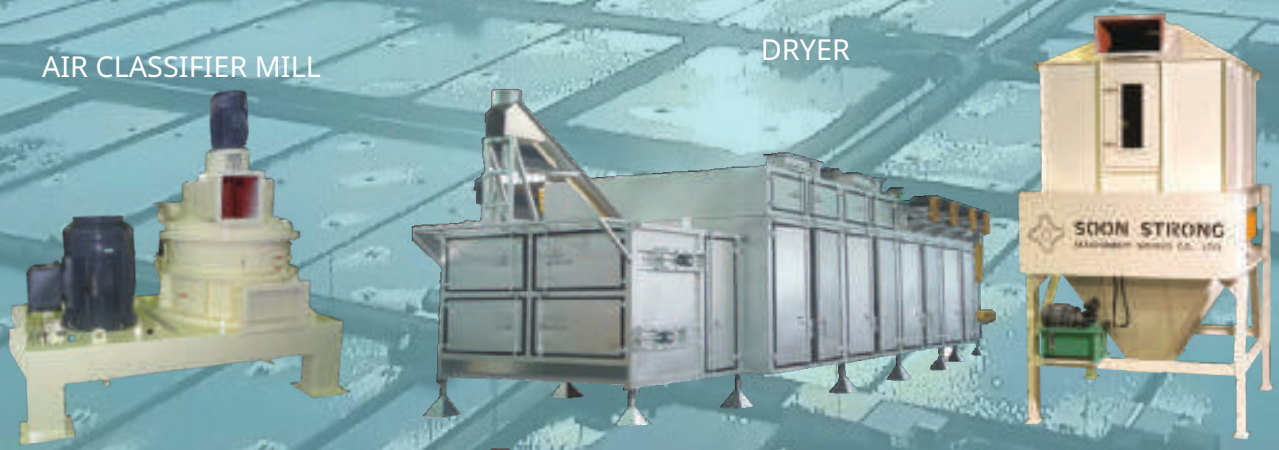


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# CRISIL sees revenues of Indian shrimp exporters rising 8% this fiscal on improved demand

*Higher revenues and lower procurement costs will help the* ***shippers sustain an operating margin of 7 per cent this fiscal.***

Indian shrimp exporters will see their revenues grow by 8-10 per cent this fiscal year as demand from key importing nations recovers and realisations improve, CRISIL Ratings said in a statement. The revenue growth will be despite the higher duties for Indian exporters in the United States and locational advantages enjoyed by key competing nations, it said.

Higher revenues and lower procurement costs will help Indian shrimp exporters sustain an

operating margin of around 7 per cent this fiscal, despite supply chain disruptions and higher

logistics costs because of geopolitical uncertainties.

Credit profiles will remain healthy as debt remains in check because of improved cash

accrual, prudent working capital management, and limited capital expenditure (capex) due to

surplus capacities. An analysis of 69 shrimp exporters rated by CRISIL Ratings, accounting

for almost two-thirds of the industry's revenues, indicates as much, it said.

Himank Sharma, Director, CRISIL Ratings, said "Indian shrimp exporters stand to benefit as demand improves for

*India, Ecuador, and Vietnam account for around two-thirds of global shrimp exports, while the US, China, and Japan consume more than half of the global produce*

two reasons. First, lower channel inventories at importers' end, who had reduced purchases in the past few months, will need to be replenished. Second, higher spending on discretionary and food items, as the economic outlook improves for Western economies (the key consumers), will drive up volume and realisations for exporters. Volume and realisations of Indian shrimp exporters will go up in tandem by 4-5 per cent each, driving the revenue growth."

**Market insights**

India, Ecuador, and Vietnam account for around two-thirds of global shrimp exports, while the US, China, and Japan consume more than half of the global produce. In the past two fiscals, Ecuador surpassed India to become the largest shrimp exporter, backed by higher acreage, a favourable climate, and significant investments to improve the genetic quality of brood stock. Ecuador also benefited from its proximity to the US and the European Union as Asian exporters grappled with higher logistics costs amid container shortages.

CRISIL said the recent investigations by the US Department of Commerce (USDOC) with regards to countervailing duty (CVD) and anti-dumping duty (ADD) on shrimp exporting nations could have a bearing on their competitiveness. Albeit, the final determination of CVD for Indian exporters and the key competing nations, along with the outcome of ADD investigations by the USDOC on Ecuador and Indonesia, will be monitorable.

**Margin Stability**

A higher ADD for the competing countries could be a shot in the arm for Indian exporters. Procurement costs for Indian shrimp players will reduce this fiscal because of better production compared to last fiscal, when the summer crop took a hit due to a sudden rise in temperatures early in the season. Thus, higher revenues and lower procurement costs this fiscal year will keep operating margins stable at around 7 per cent, despite increased logistics costs due to geopolitical tensions. The working capital requirement will moderate as purchase costs reduce. To add to that, surplus processing capacities available with Indian exporters will limit capex, which will reduce dependence on external borrowings, CRISIL said.

Nagarjun Alaparthi, Associate Director, CRSIL Ratings, said, "Strong cash flows kept the balance sheets of shrimp exporters comfortable in the past decade. As debt addition remains muted this fiscal, and cash generation will improve due to better revenues and a stable operating margin, gearing and interest coverage will improve. Credit profiles, thus, will strengthen over the medium term."

# Pengba farming initiated at Vill. Basanchak, Haldia, West Bengal

*Growing Pengba fish at Sri Bhowmick's farm*

The Pengba *Osteobrama belangiri* is a high-valued medium carp endemic to North-East India. It is a near-threatened fish species, fetches good market price, has high consumer demand in this region. In the context of freshwater aquaculture for species diversification and conservation, it is a new potential candidate species. In year 2018, Sri Sarat Chandra Bhowmick, a progressive and professional fish farmer and owner of Ganga Maa Hatchery at Vill. Basanchak, Block Haldia, Dist. Purba Medinipur, West Bengal has initiated farming of Pengba fish for the first time in West Bengal on medium-to large-scale under the guidance of Dr P. C. Das, Principal Scientist, ICAR-CIFA. Since 2018, almost every year, he procures its fry (0.5 inch size) from ICAR-CIFA, Bhubaneswar and rears them in earthen ponds. In one year, it reaches 500-600gm. Sri Bhowmick could successfully raise brooder Pengba - females look like *Hilsa ilisha* weighing 600-700gm, whereas males weigh 300-400gm, smaller & thinner than females. Besides maintaining his own stock, he has supplied brooder Pengba to CADC fish farm at Tamluk, Purba Medinipur; Kakdwip in South 24 Parganas; to Babul Mazumdar in North 24 Parganas and other fish hatchery owners at Naihati in same district and other places in West Bengal. The fish good-in-taste is sold at fish markets in Manipur at Rs 2000/-/kg on important occasions. At fish markets in Purba Medinipur, this fish, new to fish sellers, is sold at Rs 100-200/-/kg. News communicator Subrato Ghosh had on-site conversation with Sri Bhowmick on 17/06/2024.

Sri Bhowmick possesses 12 fish culture ponds on lease, 5-25 bigha in area (1 bigha = 49dec). According to him, food & feeding habit of Pengba is like that of IMC, accepts formulated supplementary fish feed that is meant for IMC (both farm-made and commercially-available), can be stocked along with IMC in grow-out ponds. Scientists from ICAR-CIFA Bhubaneswar and Rahara Centre have visited his farm. In conditions when pond water and soil turns unclean and unhygienic, toxic gases accumulate at bottom, then Pengba do not survive. Besides Pengba, Sri Bhowmick is also doing commercial farming of improved Catla, Amur carp (4-5kg in 1 year), Jayanti Rohu, Paradise Rui, butter catfish *Ompak pabda* (100-150gm in 1 year, 50gm in 6 months). He has produced brooder O. *pabda*. He received felicitation from ICAR-CIFA, Bhubaneswar on National Fish Farmers' Day in 2019 and received recognition from the Block Development Officer, Haldia Development Block in 2017. Sri Bhowmick procures good quality IMC spawn from hatchery owners at Bankura, West Bengal, does seed rearing, has separate nursery and grow-out ponds for major carps. He stocks 300-500nos of Pengba fry (2 inch size) per 40 decimal pond in composite fish culture system. In his homestead pond, in 2019, natural breeding of Pengba brooders took place; from where 3.0-3.5 inch sized seeds (fry) were produced in 3 months in nylon net hapa enclosures. His wife Smt. Bandita Bhowmick took proper care in rearing Pengba larvae, further initiative in supplying Pengba fry to local women interested in fish farming for stocking in homestead ponds, encouraging them in Pengba farming without keeping such ponds unused.

*Bhowmick at his home*

*Pond where Pengba seeds were produced*

*Subrato Ghosh, news contributor with S. Bhowmick*

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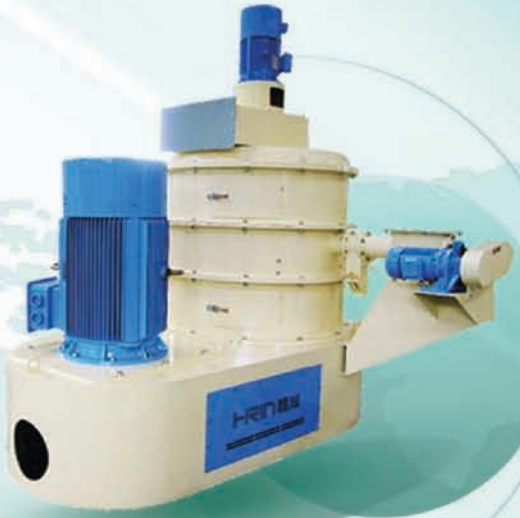

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# Seepage Control Methods in Aquaculture Ponds

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## 1. Introduction

The Fisheries and aquaculture sector play very vital role in supplying protein rich food for of developed and developing countries in world especially. It is also importance for different forms of development like employment generation, recreation and sporting, ornamental farming, area reclamation, resource conservation, ecological literacy enhancement, biomedical extraction and foreign exchange earnings, besides being major food suppliers toward food security and poverty alleviation. With the growing knowledge and demands, dimensions of fisheries and aquaculture expand rapidly. One such expansion in fish farming is to management aquacultural pond for the seepage control and this management is conceived as a potential thrust area towards building better environment for the persons living at gross-root levels. In this widening perspective, an attempt is made here to comprehend the role, potential, requirements, and package of practices for Seepage control in the Aquacultural Ponds. Hence the important aspects related with selection of an appropriate site and the remedial measures of seepage problem in fish farms are discussed in this article.

In Aquacultural ponds seepage can be the largest single loss of water. Seepage not only consumes water but it also may leach nutrients and increase the amount of lime required to maintain an alkalinity suitable for aquaculture on acidic soils. Seepage in fish ponds may be defined as water which by the action of capillary attraction passes underground from the pond surface, through close soils by general diffusion. Sometimes ponds or farms are constructed fully or partly in porous soil causing water loss by seepage through dyke and basin. In that case sealing/lining of the surface of dyke and bed is felt essential. At a time when fisheries resource base is declining, even as regional and national demand for fish grows, concerted effort to promote multiple use of resource to increase opportunities for responsible resource exploitation and incentives for conservation efforts become essential. Reducing seepage in the pond after it is built is often very difficult and expensive.

> Seepage control in aquacultural pond is very vital in order to reduce the overall cost of the fisheries enterprises if its reduction is not tackled with the proper planning and management on time then it might have harsh consequences. This article highlights few simple and mostly used methods such as Selant, Gleization, Compaction, puddling etc. to control the seepage in aquacultural ponds bed and dikes.

Seepage in Aquacultural ponds is one of the most important factors required to be studied properly, while initial site selection procedure is followed.

## 2. Some Methods to Control Seepage in Aquacultural Ponds

In order to minimize the seepage Problems in the aquacultural pond the various methods can be adopted which are widely used in the different parts of the India and world. Few methods are described here for control of seepage in fish farm ponds. Lining the pond with impervious material or treating the soil mechanically or chemically is practiced to prevent excessive water loss. This practice is applied where the loss of water in pond is too much, that it affects the complete filling of the pond.

**2.1. By Selecting Appropriate Site**

Site selection is one of very important parameters while constructing an aquacultural ponds. Selecting a poor site often the result in high investment cost. In some places no satisfactory site is available, but the need for water is great enough to justify using a site that is somewhat less than satisfactory. Investigations conducted on the design and construction of some of the existing fish and prawn farms in different regions of the country indicated that they are not profitable from a commercial point of view due to improper planning. The main reasons of failure of many such farms are because of severe seepage problem at the pond surface and due to lack of suitable water intake and management system

Excessive seepage in ponds occurs because the site was not survey properly, the soil survey was not done well; excessive removal of surface soil for dike construction has exposed highly pervious areas of sand, gravel or rock; the pond was not well designed or constructed because the site is poor; that is, one where the soils in the impounding area are too permeable to hold water. In this case the original pond design must include plans for reducing seepage by sealing. To prevent excessive seepage, the permeability of the soils is reduced to a point at which losses are insignificant or at least tolerable. The method depends largely on the proportions of coarse-grained sand and gravel and of fine-grained clay and silt in the soil.

**2.2. By Mechanical Means**

Pond sealing by compaction is relatively inexpensive. However, its use is limited to soils having a wide range of particle sizes, capable of affecting a suitable seal. Sandy and silty loam type of soils are suitable for compaction. In addition to normal compaction of dyke during construction, a layer of 15-20 cm of surface soil of pond bed and dyke is required to be compacted properly by manual and hand roller with minimum moisture content. For losing the soil before compacting we can also use plough, disc harrow, sheep foot roller and rototiller. The pond surface soil should be mixed with good clay soil before compaction. Where the clay percent is very low, it is said to be purely sandy soil at the pond base which is not at all suitable for retaining water constantly. The farm can sustain only by constant irrigation water supply system. Some pond areas can be made relatively impervious by compaction alone if the material contains a wide range of particle sizes (small gravel or coarse sand to fine sand) and enough clay (10 percent or more) and silt to affect a seal. This is the least expensive method. Because seepage losses vary directly with the depth of water impounded over an area, the thickness of the compacted seal is increased proportionately.

Puddling can also be simple way to reduce water seepage, particularly if the pond bottom is very dry, hard and has open cracks in it, is to break the soil structure of the pond bottom before filling the pond with water. This is common practice in irrigated rice fields, and is called puddling. First of all Saturate the soil of the pond bottom with water then allow the water to soak into the soil just enough to permit working and then Break the soil structure by puddling with human operated puddle such and machine operated rotary puddler.

If the bottom soil is too permeable to be sealed by this method, an alternative is to create an impervious biological plastic layer in the bottom and on the sides of the pond. Such an impervious layer is called a gley, and the process of its formation is called gleization. For gleization following process can be adopted Prepare the pond bottom by clearing it of all vegetation, sticks, stones, rocks and the like. Fill all cracks, crevices and holes with well-compacted impervious soil and then completely cover the cleaned surface with moist animal manure, spread in an even layer about 10 cm thick and then cover the manure well with a layer of vegetal material, preferably broad leaves such as banana leaves. You can also use dried grass, rice straw, soaked cardboard or paper, Cover with a layer of soil about 10 cm thick then moisten and compact very well then Wait two to three weeks before slowly filling up the pond with water

**2.3. By Chemical Means**

Some chemicals such as tetrasodium pyrophosphate, sodium tripolyphosphate, sodium hexametaphosphate and sodium carbonate are mixed to the top soil and compacted to a 15 cm thick layer for a water depth of 2.5 m. The chemical treatment is not effective if the soil is of coarse grade. Application of cow dung and cement in clayey soil are mixed properly with 15-20 cm of bottom soil, it reduces loss of water considerably. Clay percentage is increased when pond soil contains more sand. Where there is deficiency of clay soil, one per cent cement and 1-5 per cent cow dung is mixed with the pond surface soil and is rolled with watering. The pond with comparatively less seepage may be provided with a layer of clayey soil at the pond's bottom and slope and compacted properly.

**3.3. By Using Sealant/Lining**

There are various commercially available lining materials such as concrete, brick-masonry, ferro-cement, fiber glass, UV resistant plastic can also be used for arresting seepage loss in highly permeable soils. However, the cost of construction will greatly vary depending on the cost of lining materials. The ponds with moderate seepage, Bentonite clay can be used to arrest the same. Bentonite is a fine texture colloidal clay which absorbs water several times its own weight and at complete saturation swells 8 to 20 times its original volume. The bentonite is mixed with soil to a depth of 15 cm and the mixture is purely compacted and saturated. The

particles of bentonite fill the pores in the soil and makes in nearly impervious. Bentonite powder should be applied at the rate of 5-15 kg per square meter of area depending on the quality of soil. Bentonite when dried, return to its original volume and leave cracks in the pond area. Bentonite can also be applied when there is water in the pond. A coarse grade is suitable to use in this condition and it is applied uniformly to the water surface which settles to the bottom, swells and forms a seal. Low density polyethylene (LDPR) sheets may also be tried in small pond, but they are costly.

To avoid the excess seepage that to 100% in a particular soil condition, it is suggested that 80mm thick cement concrete (1:2:4) with 12 mm size stone chip with proper expansion and contraction joints may be provided on the pond bottom and on dyke up to maximum water level. The concreting work is required to be done after providing 100 mm thick sand layer with due watering and compaction.

The pond's base and slope may be provided with locally available stone with 1:6 cement mortars after 100 mm sand layer. The thickness of the stone masonry should be minimum 150mm.

1.1.1 **Plastic Linning**

In coarse textured soils flexible membranes of polyethylene, vinyl and butyl rubber can be used to prevent excessive seepage losses. Thin films of these materials are structurally weak, however, if kept intact, they are almost completely watertight. Polyethylene films are least expensive and have better aging properties than vinyl, but they are difficult to join or patch (if damaged) since repair must be performed by heat sealing.

The area to be lined should be drained and dried until the surface is firm enough to support the people and equipment to be used during the lining installation. Generally, the native soil sub grade should be disturbed as little as possible in the excavation operation to provide adequate structural bearing support. In addition, the area to be lined should be cleared of all vegetation. It is recommended to sterilize the areas to be covered with vinyl or polyethylene, since certain plants with high penetrating power can damage these thin membranes. Membrane linings should be supplied in sections as large as can be handled by the available equipment. Field splices should use a minimum overlap of 0.05 m. Splices on the side slopes should be oriented perpendicular to the water surface whenever practical. This orientation reduces stress on the joint.

All thin films, such as polyethylene and vinyl membranes, must be protected from mechanical damage with a cover of soil or soil and gravel. This is also required to protect these plastic materials from atmospheric weathering. The cover should be at least 0.15 m thick for protection from atmospheric weathering. However, they must be protected against mechanical damage, especially in the areas where they are likely to be damaged.

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# Blue blood crabs - *A new hope for cancer treatment*

**Monalisha Mishra, J. Joshi Sharon, Tanupriya Bhakta, Priyanka Sinha, Debapriyo Mukherjee, Koel Bhattacharya Sanyal and Gadadhar Dash**
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***Email:*** *dashgadadhar@gmail.com*

Horseshoe crabs are an important part of ecology of coastal community and their eggs are the major food source for shorebirds and sea turtles. Researchers have also found substances in the crabs that have potential as antibiotics as well as anti-viral and anti-cancer agents. The milky blue blood of this crab provides the only known natural source of Limulus Amebocyte Lysate (LAL), a substance that detects endotoxin which helps to detect cancer cells. Horseshoe crab secrete a variety of host defense peptides, but one in particular tachyplesin -1 (TI), has captured attention as a promising anticancer drug whose cyclic analogues are found more potent than their natural form. The Industry house will definitely find some innovative product against cancer and aids from the blood of this price less creature of the nature in near future.

**Introduction:**
Horse-shoe crabs are marine arthropods originated about 450 million years ago, existed nearly unchanged (looks exactly like their fossilized ancestors) well before even dinosaurs existed, hence called as living fossils. Its haemolymph contains a copper containing compound **haemocyanin** instead of haemoglobin which is responsible for the characteristic **blue colour** of their blood. Though they are called blue blood crabs due to the colour of their blood, they are not true crabs but instead are chelicerates, more closely related to spiders and scorpions. They got their name as Horse-shoe crabs because of their arc shaped carapace, has been compared to the shape of a horse'sshoe.

**Habitat and Distribution:**
Horseshoe crabs (Limulidae) are currently represented by four species including Limulus polyphemus, which is found along the eastern coast of North and Central America, and three Indo-Pacific species, Tachypleus gigas), Tachypleustridentatus and Carcinoscorpiusrotundicauda. All four species are similar in terms of ecology, morphology, and serology. Tachypleus gigas and Carcinoscorpiusrotundicauda are distributed along the northeast coast of India extending from the extreme north of West Bengal through Odisha to the northern coast of Andhra Pradesh. High congregations of these animals are found along the breeding beaches of Odisha & West Bengal during full moon & new moon high tides. Both of these Indian species have significantly different breeding patterns particularly in relation to their habitat and laying of eggs. Although at times both the species inhabit the same body of water, *C. rotundicauda* selects mudflats of mangroves & *T. gigas*

have the priority for sandy estuarines and creek zones for spawning.

**Uses:**
In many countries, it is used as a food delicacy. For hungry birds it's a cornucopia. Pregnant women in

***Fig1.*** *Limulus* ***sp.***

Singapore and Malaysia are said to eat the egg mass of the horse-shoe crab for immunity of their foetus. For drug companies, it's a crucial resource for making human medicines safe. That's because these animal's milky blue blood provides the only known natural source of **Limulus amebocyte lysate (LAL)**, a substance that detects a contaminant called endotoxin. When these cells meet invading bacteria, they clot around it and protect the rest of the horseshoe crab's body from toxins. These LAL test applications include quality assurance for: Intravenous drugs; biological (e.g. clotting factors, insulin and vaccines); recombinant drugs; and implantable medical devices (e.g. heart valves and orthopedic devices). Environmental applications have also increased demand for the LAL test to ensure air quality and detect endotoxin concentrations in fresh water, sea water and surrounding sediment. Such vital benefits are nonetheless dependent on a crude LAL test manufacturing process; whereby the horseshoe crabs are captured, bled, and the collected blood is centrifuged to concentrate the amebocytes. Water is then added to the packed amebocytes, causing them to lyse and release coagulated proteins; thus, the "lysate" nomenclature. China is incoming crores of money by exporting Tachypleus Amoebocyte lysate (TAAL). Before LAL, scientists had no easy way of knowing whether a vaccine or medical tool was contaminated with bacteria. Like E. coli or salmonella. Scientists would inject vaccines into huge numbers of rabbits and then basically wait for symptoms to show up. But when LAL was approved for use in 1970, it changed everything. Drop a minuscule amount of it onto a medical device or vaccine, and the LAL will encase any gram-negative bacteria in a jelly cocoon. While it can't kill the bacteria, the jelly seal is like a fire alarm. Alerting us to the presence of what could become a potentially lethal infection and prevent it fromspreading.

Besides this, china uses it for treating cancer and AIDS also. It's unlikely that cancer is a huge problem for the horseshoe crab, so why should chemists look to the ancient dweller for a cancer cure? In a chemist's eye, one of those protective strategies could potentially be adapted to work as a cancer treatment. Horseshoe crabs have evolved to produce a class of proteins to combat microbial infection called as **host defense peptides**, which are small, positively charged proteins capable of killing bacteria. Horseshoe crab secrete a variety of host defense peptides, but one in particularly **tachyplesin -1 (TI)**, has captured attention as a promising anticancer drug. The mangrove horseshoe crab, which lives ontheshores of south Asia, produces tetrodotoxin, a powerful neurological poison that has been used in the clinic to treat pain associated with cancer and heroin withdrawal. Endotoxins are known to inhibit the growth of cancer cells. Therefore, the ability of the LAL test to detect cancer cells could lead to controlled cancer therapy with endotoxins. In addition, another substance found in horseshoe crab blood may have the potential for diagnosing leukemia. This substance reacts with red and white human blood cells, including cancerous white blood cells in leukemia patients. Furthermore, a New Jersey Sea Grant project has recently discovered a rare protein in horseshoe crab blood that traces and binds with vitamin B12. These

***Fig2.Collection of limulus blood***

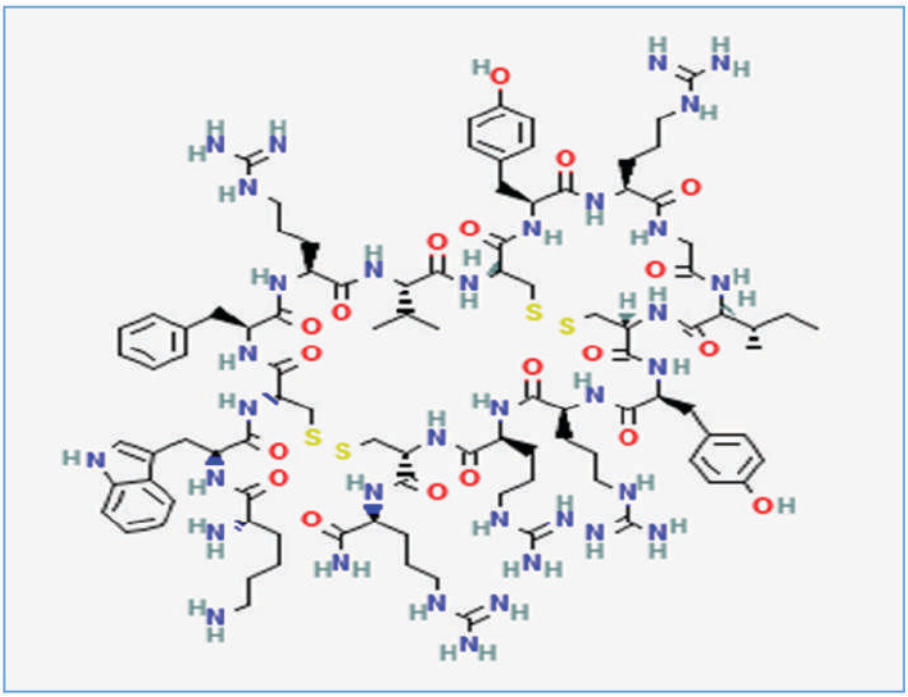

*Fig3. Tachyplesin (C99H151N35O19S4)*

findings led to the development of an accurate, cost-efficient testing kit for detecting vitamin B12-related deficiencies and diseases, which may include pernicious anemia, gastric and intestinal damage, and even mental disorders.

Early in 2019, researchers in the Peptide Therapeutics and Membrane Biology Research Group at Queensland University of Technology evaluated the ability of TI to kill a variety of cancer cells. The researchers observed that TI is particularly potent towards **melanoma**, a type of skin cancer. To make the molecule more stable in human blood, the researchers joined the two ends of the molecule like two ends of a string to create a cyclic version of TI called **cTI**. In their most recent work, the group systematically introduced small changes to the structure of cTI to try to find a more potent cancer drug than TI in its natural form. After developing nine synthetic versions of cTI, two of them stood out for their high potency and selectivity for melanoma cells. These analogues were almost **3.5 times** more selective for melanoma cells than the original TI molecule. A third analogue was capable of sneaking into cancer cells without popping them, which could be useful for designing a scaffold for drug delivery into melanoma cells. The data suggests that these cTI analogues are promising leads for melanoma drug development, and that cTI in general is a versatile starting point for cancer drug development. The horseshoe crab didn't evolve to treat human illnesses, but it produces a vast array of molecules that a chemist can modify to create new drugs, and TI is just the most recent phenomenon of thissort.

Historically, horseshoe crabs have also been used apart from the extraction of blood for safety testing. They were once harvested for fertilizer and livestock feed; but this widespread practice ended in the 1920s, as the stock of horseshoe crabs began to decline and the public nuisance of the strong odor hastened the adoption of more competitive, alternative fertilizers. Thereafter, the use of horseshoe crabs as bait in commercial fishing became popular in the 1990s. Horseshoe crabs, particularly egg-bearing female crabs, proved to be excellent bait for use in eel and whelk pots.

**Threat to the race:**

In India, habitat loss and non-target catch of HSC during traditional and semi- mechanized and mechanized fishing, are undoing its abiding presence, according to Zoological Survey of India. Along the coast of Orissa at Balaramgari, there is a tremendous change in the intertidal sands due to the shrinkage of nesting area caused by human activities such as maintenance work by fishing trawlers on the beach itself and shifting of beach sands for construction purposes at times. Thereal

threat comes from the human population, which plays an important role in the coastal ecology. In addition, natural calamities such as super cyclones and tsunamis cause serious damage by shifting the sands from the beaches. A constructive approach is needed to protect the intact, undisturbed breeding zones in India to help honeymooning horseshoe crab couples to come ashore and lay eggs. As it is evident from the present status of breeding beaches, it is a matter of concern that the day is not far away when we will not be able to encounter breeding pairs. Efforts should be made by creating public awareness, educating fisher folks, providing alternative sites for boat building and repairing, and if required, enacting laws to protect these precious guests from the brink of extinction from ourcoast.

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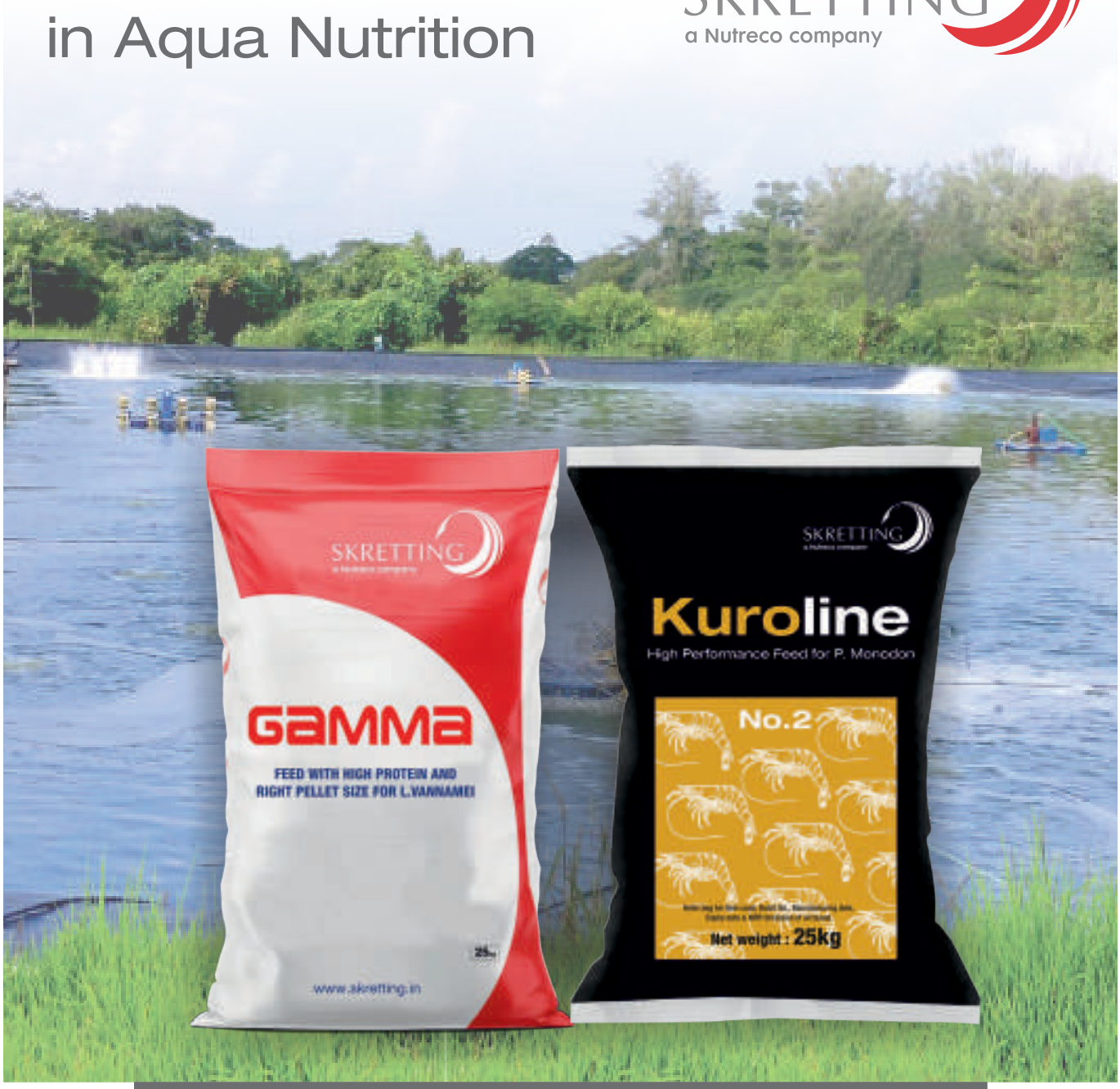


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# Abandoned Lost and Discarded Fishing Gears: The Threat they Pose to Marine Biodiversity

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**SUMMARY**

The world's oceans are being polluted with a new type of plastic. This plastic is not the kind that you can recycle or use to make new products. It is the kind that has been discarded or lost and left to float in our oceans. This specific type of plastic pollution is called "ghost gear", and it is made up of discarded fishing nets, lines, buoys, traps and other fishing gear. These ghost gears are either lost at sea or thrown away by fishermen after they are done using them. Ghost gears come in all shapes and sizes, but they all have one thing in common: they are made from plastics such as polypropylene, nylon, polyester and PET (polyethylene terephthalate). These plastics do not biodegrade like other types of plastics that can be recycled. They also do not break down when exposed to sunlight or waves. Instead, they just break into smaller pieces over time which makes them even more dangerous. Fishing gear is one of the major sources of plastic pollution in the ocean. The amount of plastic released by fishing gear varies depending on the type of fishing gear, how long it has been used, and how they are disposed. Ghost fishing is a problem that has been occurring for many years. It is a process where abandoned fishing nets continue to catch fish and other marine life, even after the fisherman has left the area. The main solution to this problem is to make sure that fishermen are aware that they are responsible for their gear and that they take care of the gear when they are done with it. They should also be educated about how ghost fishing can happen and how it affects marine life. The solution to ghost fishing is to use smart nets. These nets can monitor and detect when they catch something so that fishermen don't have to keep pulling up their nets if they don't have anything in them.

**INTRODUCTION**

Plastic is the most common form of synthetic material and it's non-biodegradable. One of the

- 1. Ghost fishing gears become a menace for the world's oceans as they continue to fish unintensely in the marine ecosystems
- 2. A national-level policy is required for the prevention, control, and management of lost and discarded fishing gear.
- 3. The main problem is the lack of awareness and knowledge regarding their impacts on the fisheries and marine ecosystem as a whole.
- 4. Smart fishing gears can be the solution for deflecting large fishes and Cetaceans based on their hearing ability

most criticized traits of plastic is its dangerous impact on the environment. Plastic can take up to a thousand years to decompose, which means that it stays in our environment for much longer than any other type of waste. The problem with abandoned fishing gear is that it's both expensive to eradicate and environmentally damaging. The social and economic problems caused by this abandoned gear include a decrease in the efficiency of fisheries and an increase in the cost of de-fishing operations. The environmental problems include the transportation of these gears across ocean waters and releasing toxic substances into the water when they decompose. Some examples of abandoned fishing gear are nets, ghost nets, etc. A large number of fishing gear are left in the sea and on beaches around the world. These abandoned gears are lost and discarded fishing gears. These abandoned gears cause damage to the environment as they can pollute the water or harm marine life.

To reduce the problems caused by lost fishing gear, The United Nations Food and Agriculture Organization or FAO has suggested that all countries should adopt a national policy for their coastal areas that provides for prevention, control, and management of lost and discarded fishing gear. Discarded fishing gear, or derelict fishing gear, is any type of bag, net, line, or other material discarded intentionally or unintentionally in oceans and seas. By 2050 there may be more plastics than fish in the ocean if we don't make serious changes to reduce these numbers.

**Types of fishing gears causing plastic pollution**

There are two types of fishing gear. The first type is an active fishing gear which includes nets, hooks, lines, and traps. The second type is a passive fishing gear which includes buoys and markers. The third type of fishing gear that is overseen by this article, but not the topic of this article, includes the plastic waste that finds its way into the oceans from ships or coastal pollution. The costs incurred from lost fishing gear such as buoys and markers can be gauged in terms of both economic costs as well as mismanaged marine populations and natural resources as they are coral reefs and fish habitats.

**Economic loss incurred due to plastic pollution**

It is estimated that a fishing net weighing one kilogram has the potential to catch and kill around 10,000 sea animals. Netting can cause physical damage to any creature it encounters. For example, if a fish's mouth becomes trapped in the net, then its gills are suffocated. Some creatures will be killed immediately by entanglement in the mesh of the net, whereas others will drown because of their inability to swim against the force of water going through the mesh.

**Impacts of Plastic pollution on wildlife**

Marine life and biodiversity have changed drastically over the years. How these effects will play out in the future is unclear, but it is safe to say that they are irreversible. Many factors contribute to these changes, including pollution and climate change. With such a large amount of change occurring in our oceans, it is difficult to predict how human interference will affect marine life and its biodiversity in the future or how it will affect us.

*FIGURE: 1 Discarded nets dumped at shores at Versova landing center*

*FIGURE: 2 Discarded plastic fishing materials on shore at Versova landing centre*

There are some predictions about what may happen in the future due to human activities on marine life. Some scientists believe that due to pollution coming from land, there could be a decrease in fish populations because of reduced amounts of phytoplankton being available for them to eat. Others believe that with climate change there may be more organisms living farther north because they can no longer survive down south where temperatures are higher and water levels have risen. These predictions could be wrong as well though because there has been an increase in ocean acidity over time. Ghost gears are left out in the environment by fishers who are done with their fishing voyage. Wind and waves carry them away from their original location. These gears may be sunken, abandoned onshore, or floating at sea. Moreover, these ghost gears pose a considerable threat to marine life and ecological balance. The main reason behind this is that these gears can entangle fish, dolphins, turtles, and other aquatic creatures. They can get cut off from the surface of water due to algae growing on their surface. Moreover, these ghost gears attract plastics and garbage to form harmful plastic soup around them.

Ultimately accumulating all sorts of toxic material in water bodies which pollute water for generations to come.

**SOLUTIONS**

One of the ways for tackling the menance Another way that can be considered is a tracking system called EAGLE (Exploring Aquatic Gear liberation & Recovery). This tracking system lets fishermen know where they left their gear so they can go back and remove it themselves. Ghost gears are the lost and abandoned fishing gears that are in the water. One of the common ways to stop them from releasing into the marine environment is by either sinking or recycling them. The use of ghost gears has been banned in many countries. Many organizations have come up with solutions to address the issue of ghost gears release in the marine environment. The most popular methods include sinking and recycling these items, banning their use, and educating people about why they should not dispose of them in water.

We should create more awareness about this issue among people through social media platforms like Facebook and Twitter. We should restrict the usage of such gear as it is toxic for the environment as well as other creatures present in water bodies around us. The main problem is the lack of knowledge on how fishermen release ghost gears. Ghost fishing gear is often abandoned by fishermen and released into the marine environment, leading to death for fish and other aquatic animals. There are many ways to solve this problem and prevent fishers from abandoning ghost gears. One way is to make sure that fishermen who are using ghost gear know how to dispose of it properly. Another way is to provide them with a recycling program where they can take their unused fishing gear back in exchange for a discount on their next purchase. One another way is to do fishing using smart nets. These nets can monitor and detect when they catch something so that fishermen don't have to keep pulling up their nets if they don't have anything in them. To solve the issue in lesser extend, Smart fishing gears can also can be designed especially for the Cetaceans using sound deflecting mechanism in the fishing gears as the Cetaceans having very powerful hearing mechanism and virtue of that, the cetaceans can change their route and escape from the ghost gears.

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# Assessment of gender roles in small-scale culture-based sectors in Kerala

- Aquaculture sector in India is critically affected by gender disparity in terms of pay and job status
- Women were involved in only 17.56% of the labour hours in farm activities.
- Women contributed to 37.8% of the total family labour.
- There is severe gender pay disparity in aquaculture sector.

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**Introduction**

India is the second largest producer of fish in the world, accounting for 8% of global production (FAO,2022). The export of 5.95 billion USD in value signifies its contribution to fisheries trade globally (MPEDA,2021). Despite these significant contributions, our domestic people are affected by low fish availability, low protein intake, malnutrition etc. In this scenario, the Government of India identified aquaculture as a sunrise sector to meet our protein demand and export needs. In order to address critical gaps in fish productivity, technology, quality and modernise the fisheries sector, the central government has initiated an umbrella scheme (PMMSY, 2020). The scheme is proposed to increase the estimated aquaculture production of the country from 14.16 million tonnes (DOF, 2020) to 22 million MT by 2025. Doubling the income of farmers is also another target of PMMSY.

PMMSY thus recognises aquaculture as a promising enterprise for doubling the income of farmers by critical governmental interventions. The sector is critically affected by gender disparity in terms of pay and job status. Not many literatures reported the gender issues in aquaculture, except a few such as Brugere and Williams (2016). Literature by Rajaratnam and Mcdougall (2017) stated aquaculture as a highly gendered industry and that more men than women participate in the sector and are subjected to lower status jobs and pay inequalities.

In the present study, we tried to address the knowledge gap in the magnitude of contributions by women in the aquaculture sector of Kerala. Purposive random sampling of districts of Kerala were done for data collection. A structured schedule was prepared and details on asset and liabilities, occupation, expenditure and income details were collected and analysed. The analysis segregated gender details in two major heads, such as gender involvement and gender pay.

**Gender involvement**

The study identified thatmen were involved in 82.4% of the total labour hours for culture activities,while women were involved in only 17.56% of the labour hours. Most of the culture ponds (small sized) were managed and maintained by family labourers. Women contributed to 37.8% of the total family labour in culture ponds. Segregation of gender

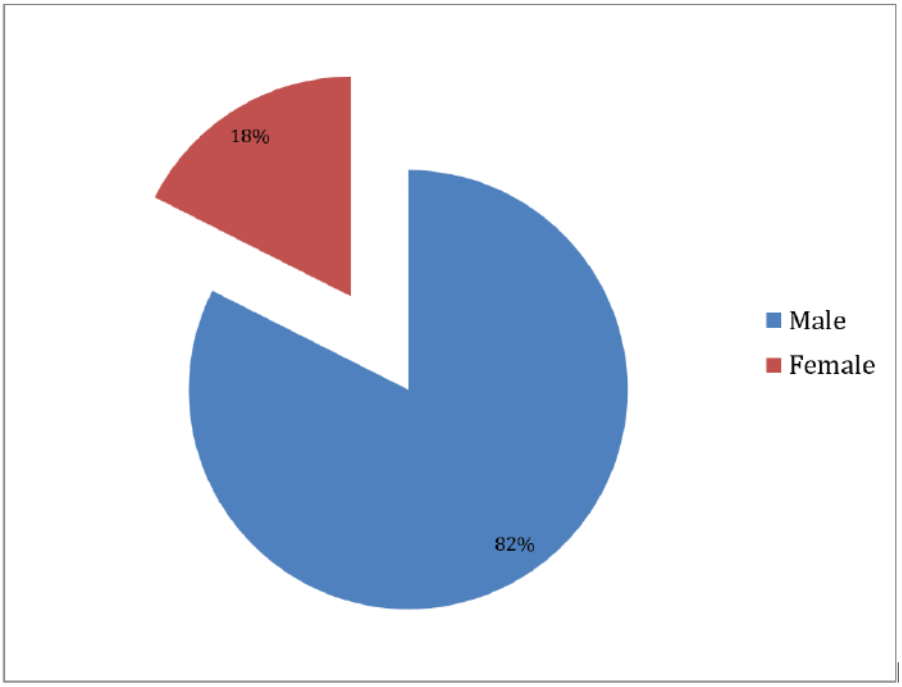


*Fig 1 Gender wise Contribution of labour in aquaculture activities*

specific labour hours indicated that women spend 67% (94 hours /cent) of labour hours in pond preparation and feeding which is a major activity of farm management. However, women are not involved in seed stocking and watchward. The other significant tasks undertaken by women were watering and fertilisation of ponds (9.6%) which is the prestocking phase in farming (Fig 1).

**Gender income**

The study revealed that there is a gender based pay disparity in aquaculture activities. Men are being paid Rs. 650-800/day, whereas women get only Rs. 250-300/day. The study projected the estimated cost for women labour in aquaculture is 1370/cent which approximately one tenth of the wages paid to men. Comparative assessment of labour cost/cent of aquaculture farm indicates the disparity in labour cost. Total labour cost if men do all work is Rs. 21842.6/cent, whereas labour cost when women does all work is Rs. 7800.9/cent. The current total labour cost involved in farm management was found to be Rs.18006.4/cent (Fig 2). These statistics clearly identify pay disparity in the aquaculture sector.

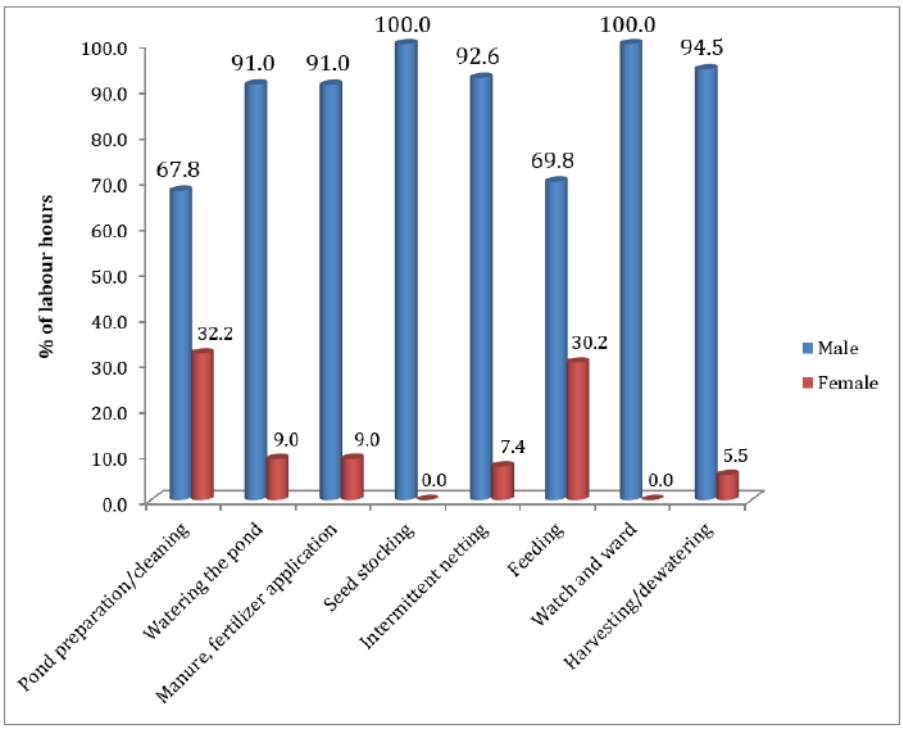


*Fig 2 Gender wise contribution of labour(hours) in various activities*

***Conclusion***

Aquaculture is traditionally male dominated sector where very few women entrepreneurs would venture into. Most of the financial power lies with men . The gender based wage disparity that exist in aquaculture needs to be addressed with policy changes in the government. Apart from ensuring minimum wages for women, they shall be promoted with entrepreneurial skills, financial and technical assistance. Granting aquaculture and fishing permits or licenses in the name of women in the family can be an alternate way to boost gender involvement in the sector.

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# Sea Lily: A lesser-known marine Echinoderm

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- Sea lilies are falls under echinoderms with 500 million years lineage. They are diverse in India waters with 86 species.
- They inhabit various depths, with high biodiversity in West Pacific, Western Atlantic and North-eastern Atlantic.
- Sea lilies have calcareous skeletons with feather-like arms, adapting to different environments.
- They are filter feeders, aid in nutrient cycling and sediment stabilization.
- They face threats from deep-sea trawling and mining, necessitating conservation.

**Introduction**

Sea lilies, members of the Crinoidea class within echinoderms, boast an impressive lineage dating back 500 million years to the Ordovician period. The evolutionary saga of crinoids commenced with stalked forms, specifically the sea lilies, attaining their zenith in diversity during the early Carboniferous era. Despite their plant-like appearance, sea lilies have been integral to the marine ecosystem, since the Ordovician, leaving behind a wealth of fossil records.

These fascinating organisms exhibit varying lifespans across species, with some enduring up to 80 years in their natural habitats. The enthralling history and remarkable resilience of sea lilies render them a captivating subject for scientific inquiry, shedding light on the intricate tapestry of evolution within the marine ecosystem. The exploration of sea lilies has resulted in the documentation of over 6,000 fossil crinoid species, while the contemporary seas host a minimum of 660 recognized modern species.

India stands as a well-represented region for the Crinoidea class, serving as the ancestral group for all echinoderm classes. This region hosts 2 orders, 16 families, 42 genera and 86 species of crinoids, colloquially referred as sea lilies and feather stars, due to their feather-like arm structure. These diverse crinoid species include 86 in India, with specific reports detailing their distribution across various locations (James, 2008; Sadhukhan and Raghunathan, 2012, 2013; Venkataraman et al., 2004; Sastry et al., 2005, 2007; Raghunathan et al., 2013; Nigam et al., 2015).

**Habitat**

Sea lilies exhibit a diverse distribution, ranging from subtidal fringe zones to considerable depths in tropical, temperate, and polar waters. The concentration of sea lily biodiversity is observed in three major areas; tropical West Pacific, where Isocrinida members prevail at varying depths, tropical western Atlantic, exhibiting greater diversity at upper water levels and Northeastern Atlantic, demonstrating higher diversity at deeper water levels. Crinoids, with their delicate appearance, settle on hard surfaces such as rocks and coral reefs, forming what can be described as 'forests' on the seafloor. This

not only highlights their anchoring behaviour, but also contributes to the formation of a diverse ecosystem. These marine organisms inhabit areas with high current flow, adopting vertical filtration fan postures or radial feeding postures in areas with lower currents. However, the complexity of the substratum plays a

crucial role in determining the crinoid community, regardless of water flow. A highly complex substratum tends to support a high diversity of crinoids, while a homogenous substratum fosters a lower diversity within the crinoid community. This interaction underscores the significance of the seafloor environment in shaping the diversity and distribution of crinoids in marine ecosystems. Stalked crinoids form dense clusters in deep waters, lacking a diel pattern of emergence, due to the absence of light. Typically attached to hard substratum, their depth distribution is influenced by variations in hydrodynamic vulnerability and the abundance of food particles reaching the seafloor.

**Anatomy and Biology**

Crinoids, distinguished within the echinoderm family, exhibit pentamerous symmetry with a unique mouth position and an endoskeleton composed of calcareous plates, forming the calyx, tegmen and arms. The calyx, a rigid cup, serves as housing for the digestive tract, while the tegmen, an upper membrane, provides openings for both mouth and anus. In sea lilies, the anatomy involves a stalk with columnals held together by ligaments, facilitating movement and anchoring. Cirri, hair-like structure extending from the columnals, play a role in anchoring and movement. Additionally, sea lilies have five arms, potentially branching into 200, each adorned with pinnules that assist in transporting food to the central mouth. The categorization of crinoids relies on morphological features such as arm shape, arm number, and stem structure. The calcium carbonate framework in sea lilies contributes to rigidity, enabling an upright posture and efficient filter feeding. Ligaments in the stalk demonstrate non-linear mechanics, showcasing adaptability to changing conditions. Its variable properties, under physiological control, emphasize the remarkable structural features of sea lilies. Furthermore, ambulacral grooves with podia play a crucial role in a complex feeding mechanism, facilitating the capture of phyto- and zooplankton, as well as detritus. As nocturnal filter feeders, sea lilies utilize tube feet, cilia, and mucus for the efficient capture of plankton and detritus. They efficiently scavenge dead organisms on the ocean floor, utilizing arms to filter particles from sediment. The arms, adorned with tube feet and sticky pads, play a crucial role in manipulating and transporting food towards the central mouth. The ability to control buoyancy optimizes their positioning for feeding and reproduction, underscoring the intricate adaptation strategies employed by these fascinating echinoderms. Sea lilies showcase a relatively low metabolic rate, adapting their activity to food availability, light, and temperature. Their distinctive mode of movement involves anchoring to the ocean floor using cilia-generated water currents, emphasizing their adaptive feeding strategies. Additionally, they can detach and swim by curling their arms, showcasing versatility in response to environmental conditions, notably observed in juvenile sea lilies. Adaptability is evident in their feeding strategy, adjusting arm spacing and angle to optimize efficiency based on environmental factors. The diversity in size among these creatures is noteworthy, with living crinoids exhibiting arms ranging from 0.39 to 13.8 inches, while the stem of sea lilies can reach about 3.3 feet.

**Reproduction**

Sea lilies, displaying dioecious characteristics, showcase distinct sexual dimorphism between male and female. Ova size ranged from 0.004 to 0.012 inches (100 to 300 µm). Maturation involves ovulation, where the maturing oocyte enters the ovarian lumen, undergoes two divisions, and transforms into ova. Crinoids achieve maturity in 12 to 18 months, and the gametogenic cycle spanning about a year, albeit varying among species. Gametes are released into the water, and upon fertilization, sea lily eggs hatch into free-floating larvae, contributing to dispersion and propagation. The majority of crinoids have two larval stages: initial stage is characterized by a non-feeding

auricularia with partially longitudinal ciliary bands, followed by the second stage, featuring a doliolaria larva with circumferential ciliary bands. Larvae metamorphose into adults, exhibiting a unique life cycle involving both free-swimming and sessile stages. During the larval phase, sea lilies feed on plankton and small organisms in the water column, transitioning to a sessile adult form upon maturation. Attached to the seafloor, they engage in filter feeding and reproduction. This intricate life cycle underscores the adaptive strategies employed by sea lilies in utilizing different stages for survival and propagation in their marine environments.

**Interaction with other marine organisms**

Sea lilies engage in intricate relationships with various marine animals. They face predation from cephalopods like squid and octopus, utilizing powerful beaks to breach the sea lily's protective plates. Sea stars and sea urchins also prey on them, employing tube feet to open the plates and access the soft tissue. The sea lily possesses remarkable resilience against predatory attacks, showcasing an exceptional ability to regenerate its main body parts. Even in the face of damage to its internal organs, or visceral mass, the sea lily can undergo restoration without succumbing to mortality. Despite these challenges, sea lilies establish symbiotic associations with other marine creatures. Certain shrimp and crab species, for instance, find refuge among the sea lily's arms, utilizing them as protection from predators. Molecular phylogenetics studies reveal close relations between sea lilies, sea stars, and other echinoderms, indicating their evolution to occupy specific niches in marine ecosystems. This evolution, coupled with their distinctive morphology and behavior, has enabled sea lilies to thrive in diverse environments.

**Ecological significance**

Sea lilies, functioning as adept filter feeders, employ their feather-like arms to capture plankton and organic particles, thereby playing a crucial role in nutrient cycling within the ocean's depths. This feeding behavior not only regulates the population of small organisms, but also exerts influence on the broader marine food chain. Additionally, their ecological significance extends to soft sediment environments, where they actively contribute to sediment stabilization and erosion prevention. Beyond their ecological contributions, sea lilies function as sensitive indicators of deep-sea ecosystem health, responding to environmental changes. Monitoring their populations offers valuable insights into the overall well-being and stability of these habitats. The intricacies of their stalk and arm structure create a complex habitat, anchoring them to the substrate and providing a foundation for other marine organisms to attach and thrive. Sea lilies prefer areas with moderate to strong currents for efficient filter feeding. They are integral components of marine ecosystems, offering habitat and sustenance to various organisms. Additionally, their filter-feeding behavior contributes to water quality maintenance and nutrient cycling. As crucial contributors to the fossil record, sea lilies provide invaluable information about past marine environments and evolutionary processes.

**Conservation challenges**

Despite being adaptable, sea lilies face conservation challenges arising from human activities such as deep-sea trawling and mining. These practices pose threats to sea lily populations and the intricate ecosystems they call home. To protect these ancient creatures and other vulnerable marine species, it is crucial to enact conservation measures. This involves advocating for sustainable fishing practices and creating marine protected areas in deep-sea environments. Such initiatives are essential to ensure the continued existence of sea lilies and the preservation of their fragile habitats.

**Conclusion**

Sea lilies, possessing an ancient lineage and unique biology, emerge as fascinating dwellers in the deep ocean, representing both enigma and fortitude in marine ecosystems. Their mystique engages the interest of scientists and nature enthusiasts alike. As we explore the mysteries of the ocean, it becomes essential to actively contribute to the preservation of these extraordinary creatures and the delicate ecosystems, they call home.

**Suggested materials for further reading**


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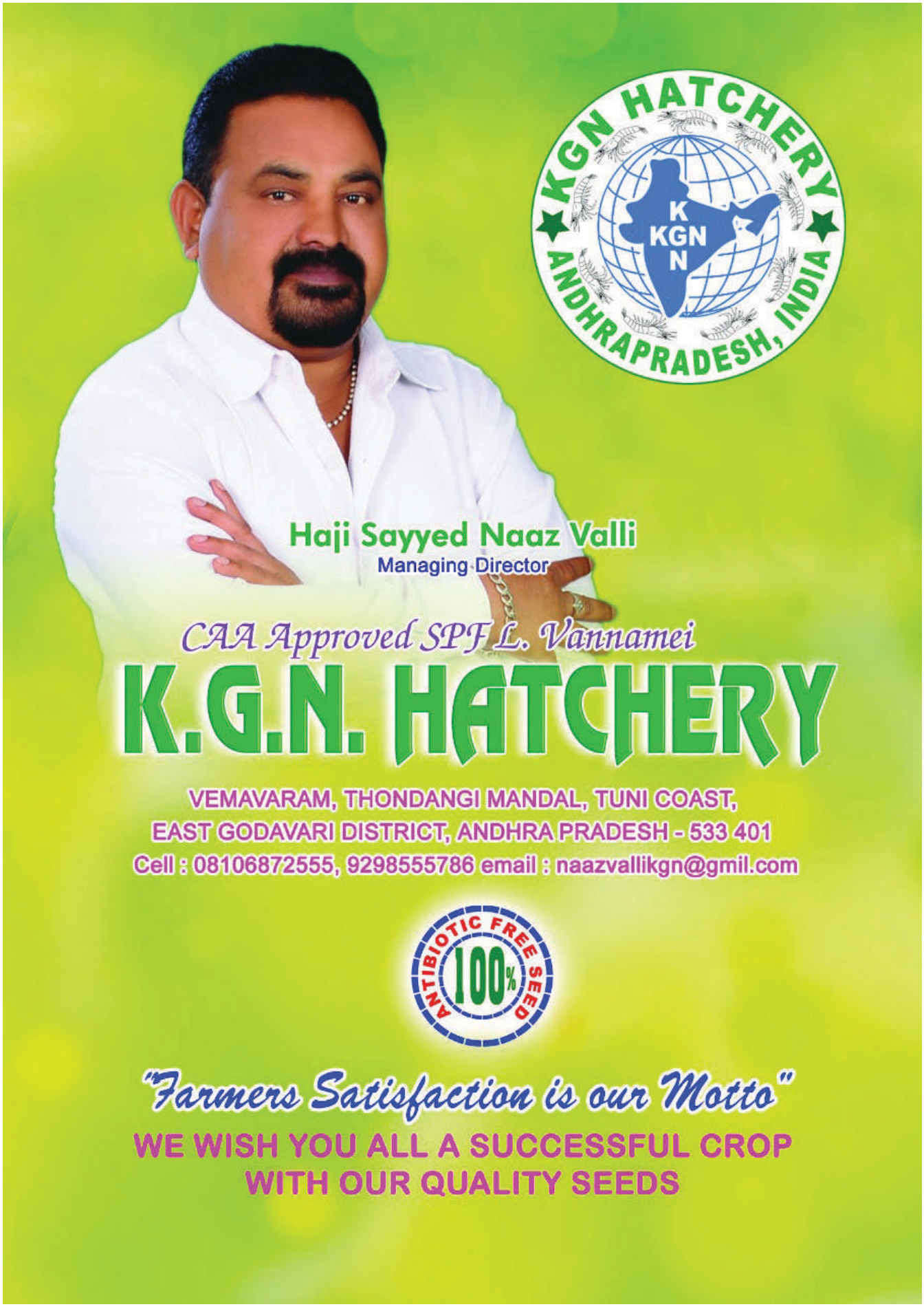
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