



भारत सरकार
GOVERNMENT OF INDIA
मत्स्यपालन विभाग
Department of Fisheries



FISHTech Report



“To Explore Technologies in Fisheries and Aquaculture Sector”



20
26
January

MANAGE Fisheries Innovation and Startup Hub (MANAGE - FISHub)

(A National Fisheries Incubation Centre Supported by the Ministry of Fisheries, Animal Husbandry and Dairying, Govt. of India)

National Institute of Agricultural Extension Management (MANAGE)

(An Autonomous Organization of Ministry of Agriculture and Farmers Welfare, Govt. of India)

Rajendranagar, Hyderabad – 500 030, Telangana, India

<https://www.manage.gov.in/managefishub/>



MANAGE FISHub



MANAGE-FISHub



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FISHTech Webinar



FISHTech Webinar series is a flagship online knowledge-sharing initiative of MANAGE-FISHub, designed to showcase innovative technologies developed by fisheries research institutions, ICAR institutes, State Fisheries Universities, and other academic and R&D organizations across India. The series aims to bridge the gap between technology developers and end users by creating a structured national platform for technology dissemination.

Objective of the Webinar

- To disseminate knowledge on emerging fisheries technology developed by fisheries institutes.
- To facilitate technology awareness among budding aquapreneurs, innovators, rural youth, students and fisheries professionals.
- To showcase commercialization pathways and startup opportunities to linked with institution developed fisheries technology
- To strengthen capacity building through expert led sessions.
- To facilitate interaction among scientists, startups, aspiring aquapreneurs and students, thereby fostering collaborative learning and innovation ecosystems.

Program Schedule

The MANAGE-FISHub Webinar Series was organized as a structured 8-day intensive program, with each day dedicated to covered cutting-edge technologies and emerging trends within the fisheries sector.

INAUGURAL SESSION

Setting the context for the days topic

TECHNICAL PRESENTATION

Detailed lecture by a subject matter expert from KUFOS

Q & A SESSION

Interactive Forum for participants queries



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Promotional Activities

The outreach focused on both institutional and public digital platforms

Regular updates and speaker profiles shared across social media handles

Short coming soon posters were used to redirect the participants

A Key collaborating partner, KUFOS promoted the series through their internal WhatsApp Group

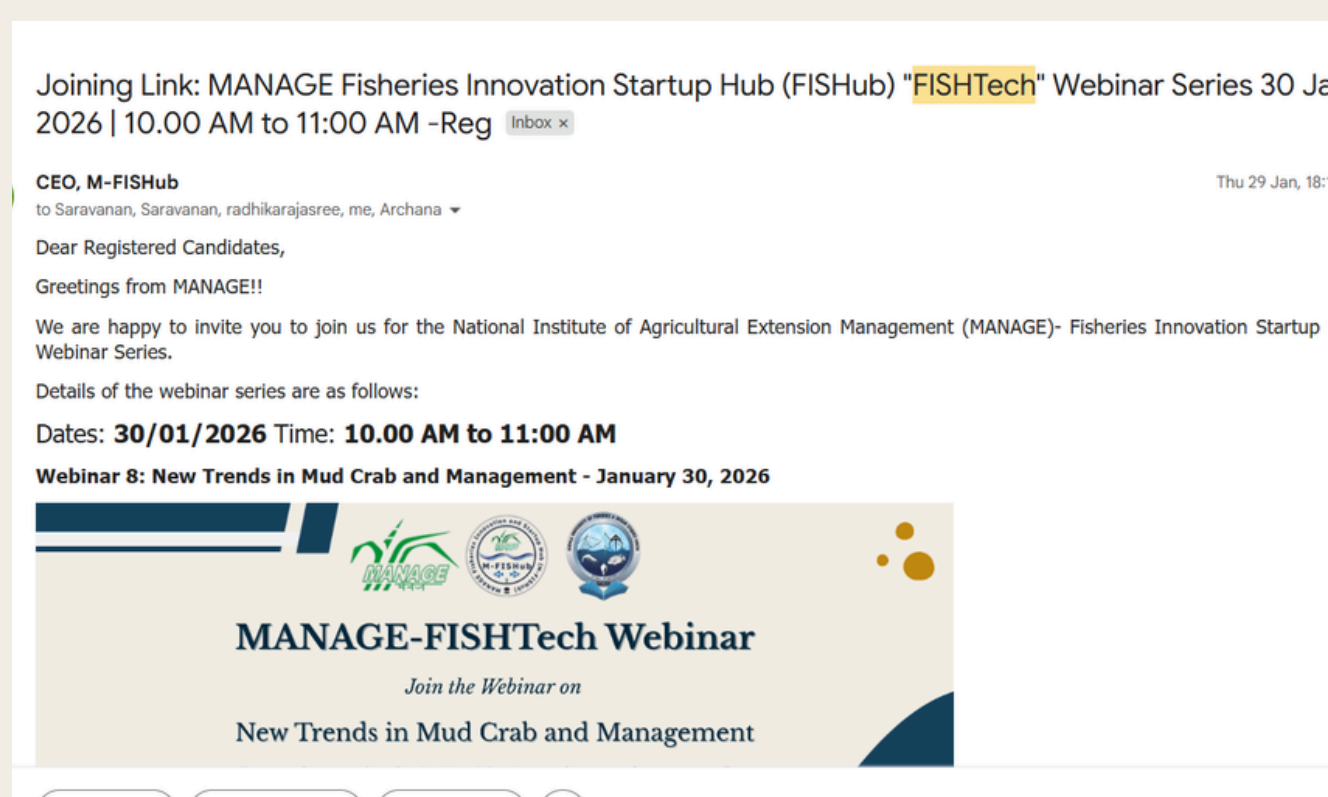
Information brochures and daily session links were shared through all WhatsApp groups



Formal invitation and program posters were sent to various fisheries colleges, KVKs and Participants of MANAGE-FISHub Program

Personalized emails were sent to the MANAGE-FISHub participants

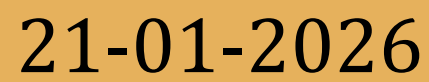
Regularly reminder Email were sent to registered participants 12 hours and one hour before each live session



1



*Captive
Breeding*



21-01-2026

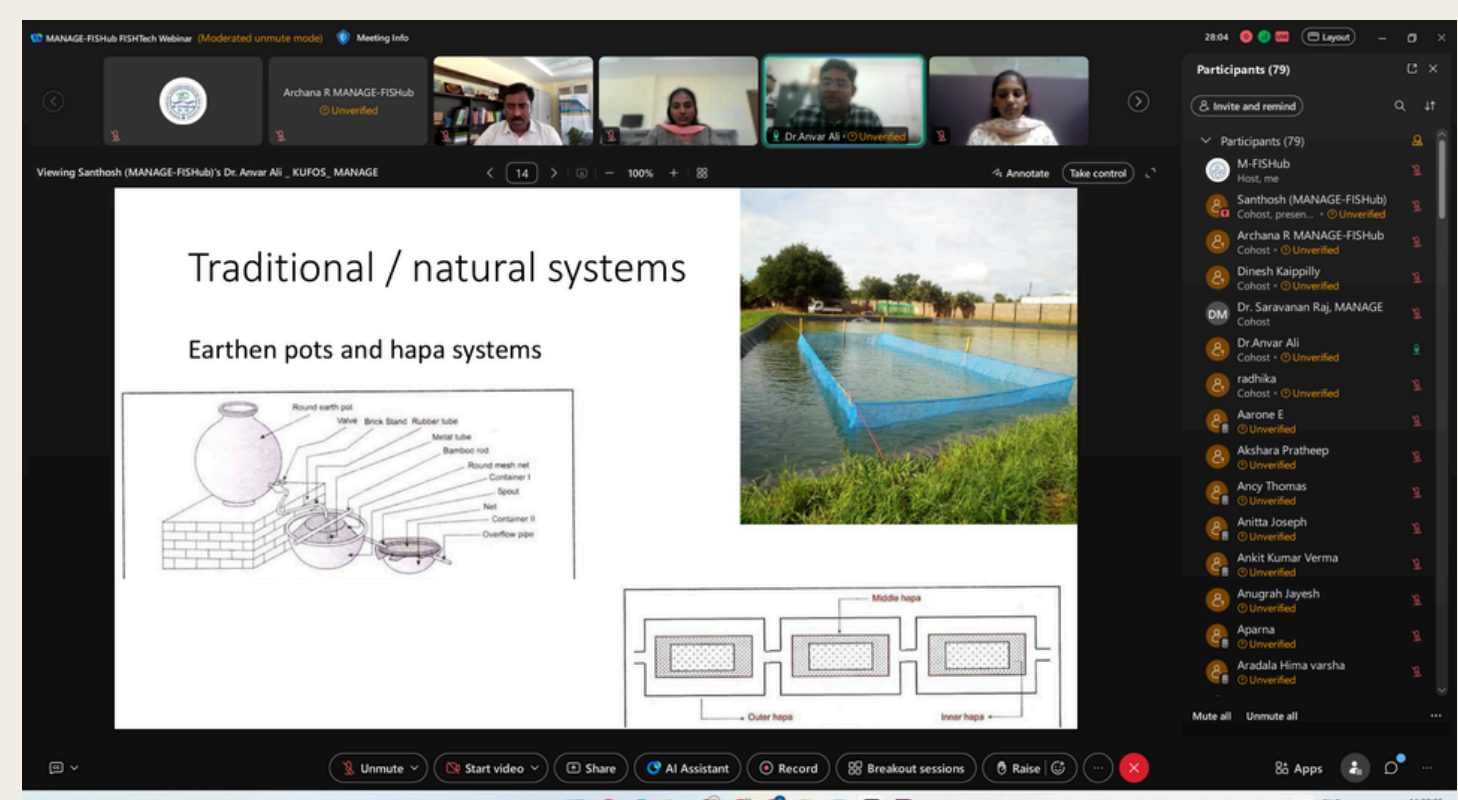
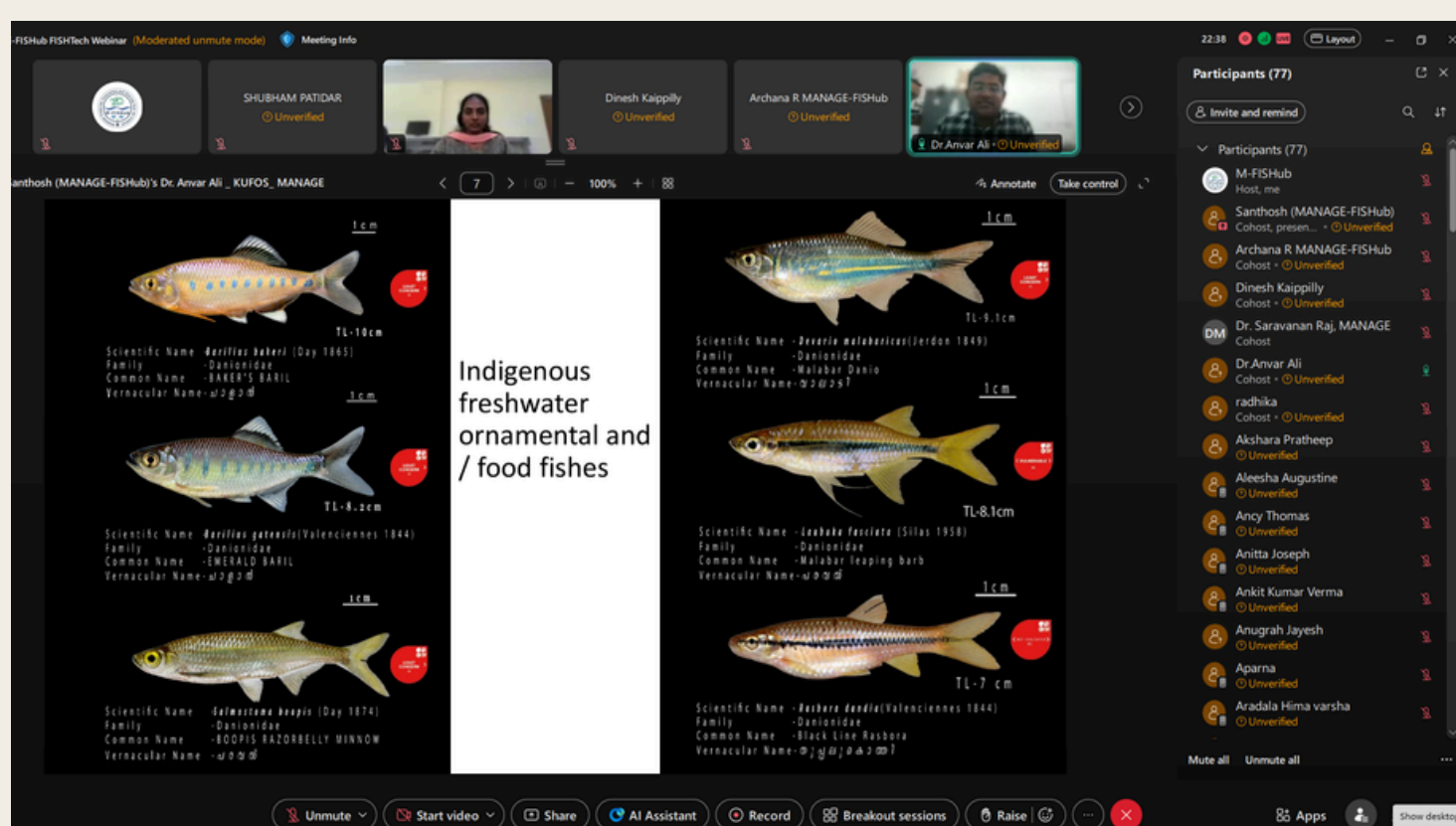


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He emphasized the importance of understanding fish reproductive cycles, gonadal maturation, feeding habits, and environmental triggers for spawning. Proper broodstock development involves acclimatization, disease-free maintenance, and feeding with nutritionally balanced diets to ensure optimal reproductive performance.

Breeding Techniques and Hatchery Technologies

He provided detailed insights into induced breeding techniques using hormonal stimulation, including the use of pituitary gland extracts and synthetic hormones such as **GnRH analogues and dopamine inhibitors**. These hormonal interventions help induce spawning in species that do not naturally breed under captive conditions.

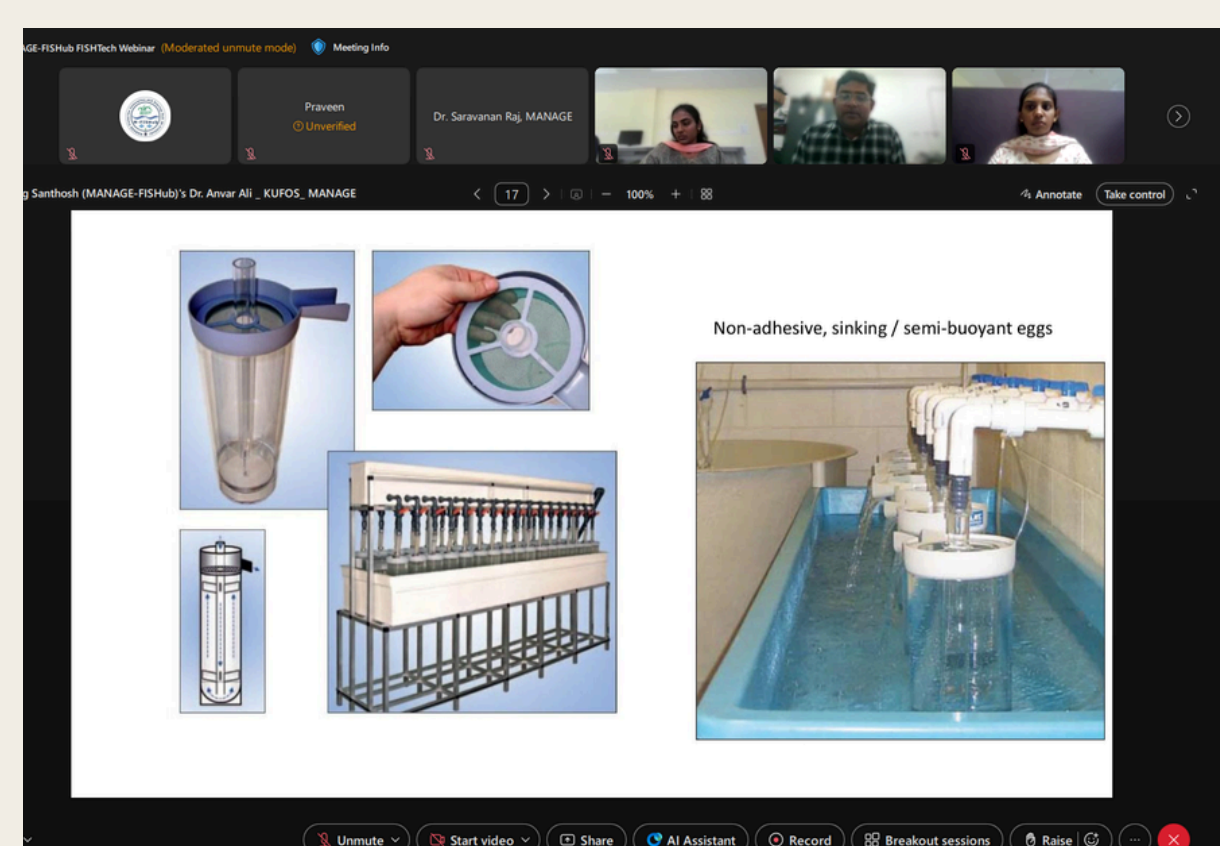
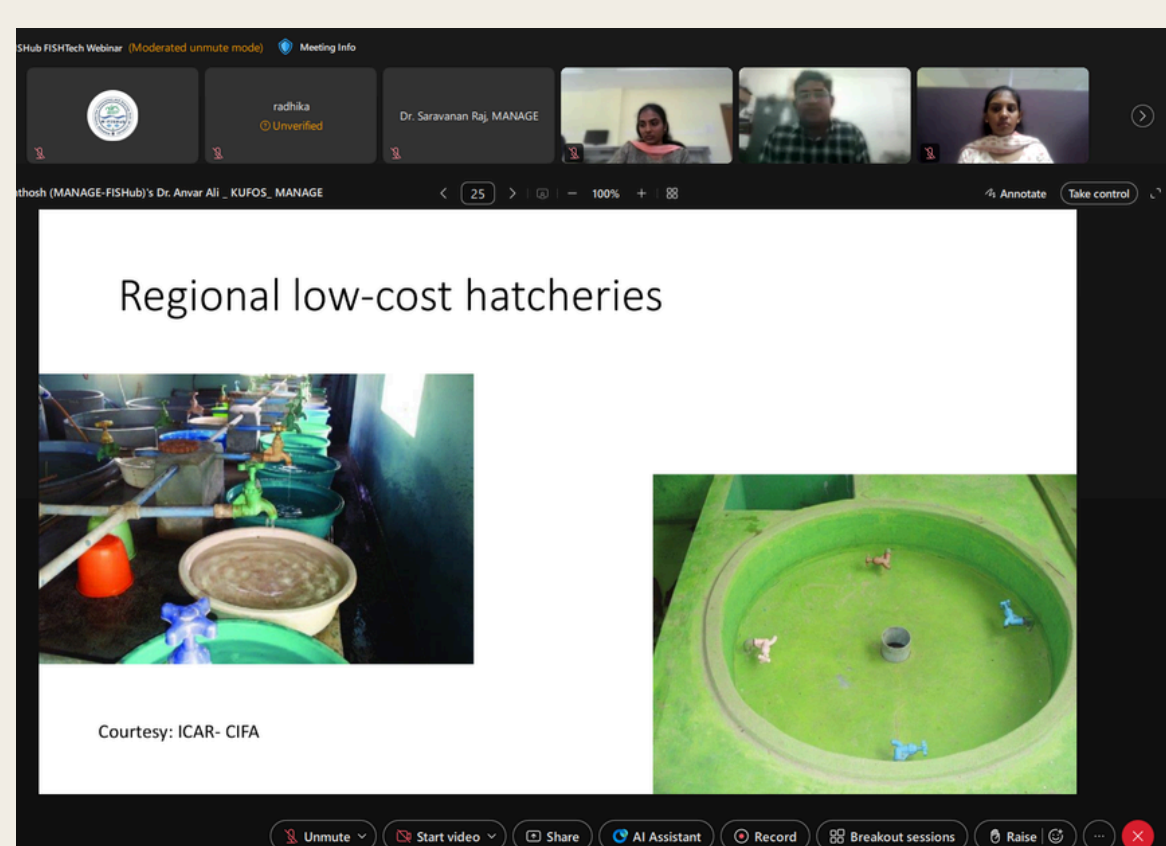
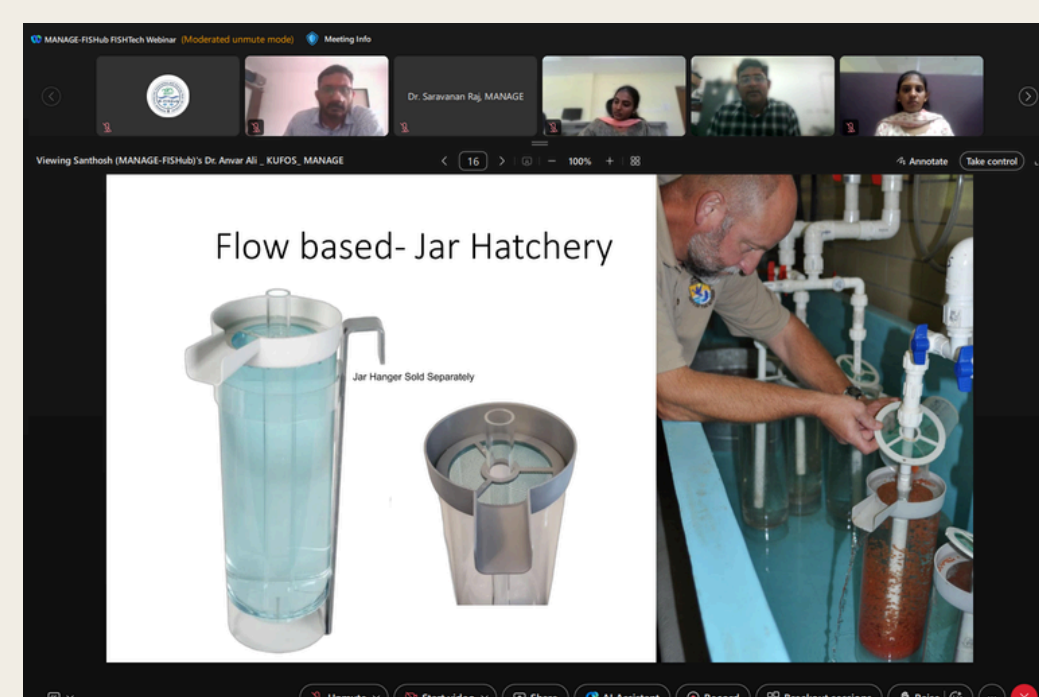
He presented various hatchery technologies, including

- Hapa breeding system
- Jar hatcheries
- Portable hatcheries
- Modern Recirculating Aquaculture Systems (RAS)

All of which support efficient seed production, optimize egg incubation and increase larval survival.

He also emphasized that newly hatched larvae initially depend on yolk sac reserves for nutrition. Once the yolk sac is absorbed, external feeding becomes essential. Live feed such as **rotifers, copepods, Moina, and other zooplankton** are crucial during early larval stages due to their appropriate size and nutritional composition. Proper feeding schedules, stocking density management, and water quality maintenance significantly influence larval survival and growth. After the larval stages, fry are transferred to nursery systems for further growth.

In conclusion, Dr. Anvar Ali emphasized that captive breeding technologies are essential for sustainable aquaculture development, conservation of aquatic biodiversity, and enhancement of rural livelihoods. He encouraged wider adoption of scientific hatchery technologies to promote species diversification and ensure long-term growth of the fisheries sector.





Q & A Session

1. How can spawning be induced in fish species that are difficult to breed in captivity, such as deep-water fishes?

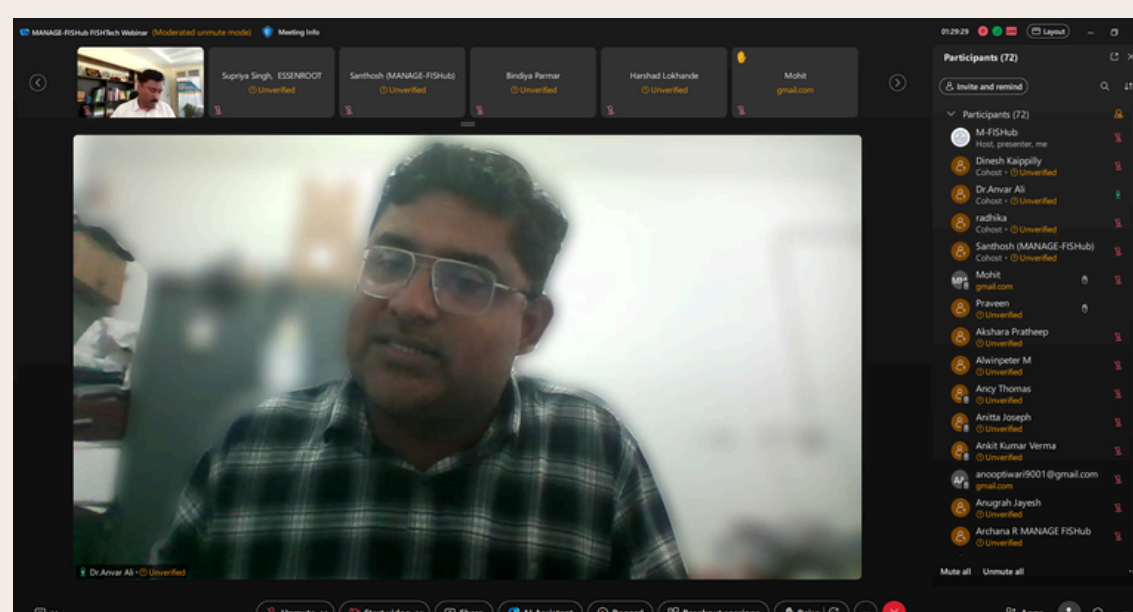
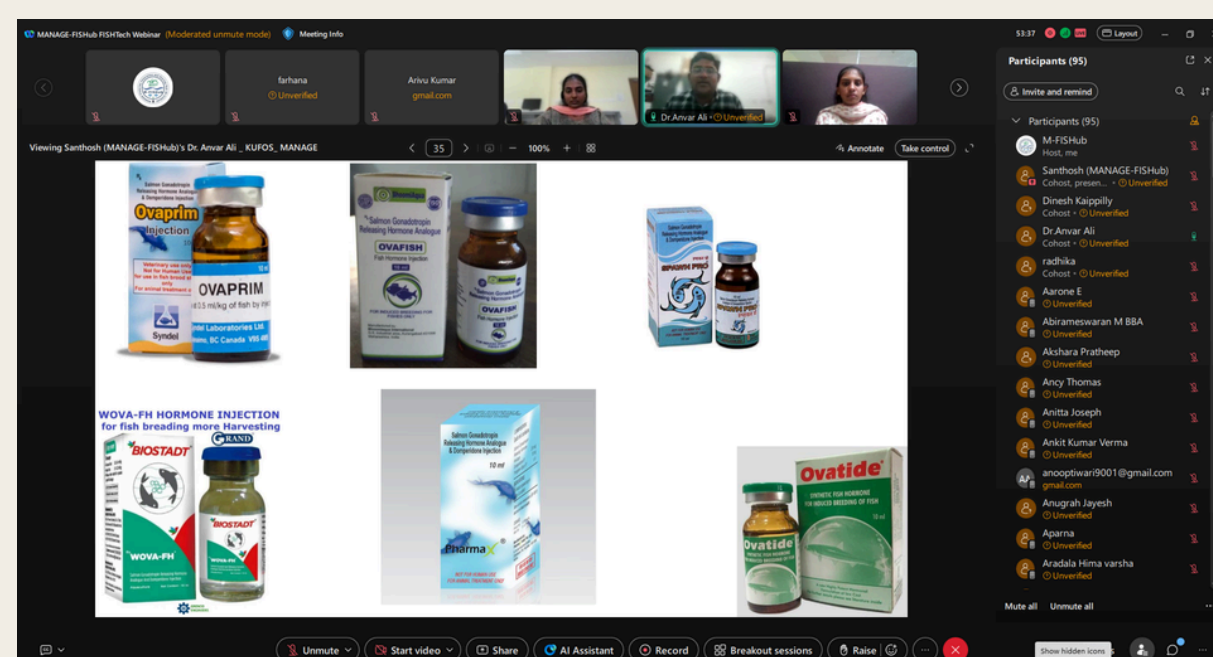
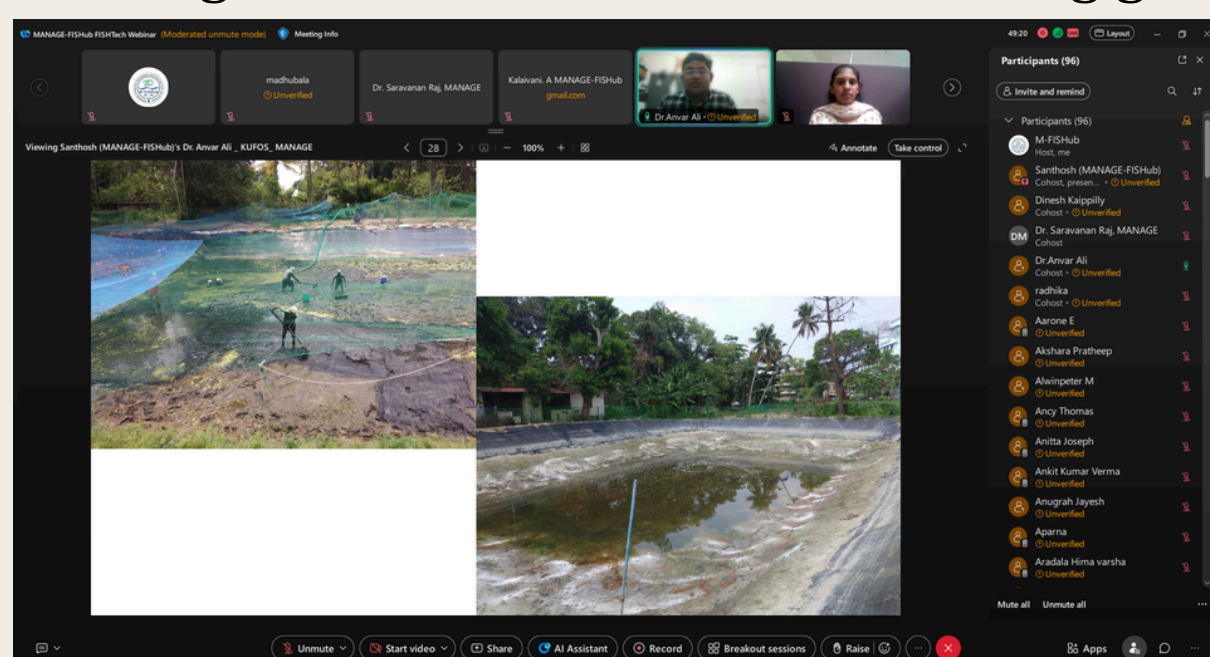
To breed difficult fish like those from the deep sea, experts use a process called induced breeding. First, they give the fish a hormone injection that tells the fish's body it is time to release eggs. Next, they make the tank feel like the ocean by keeping it dark and cold. If the fish still don't lay eggs on their own, the breeder gently squeezes the eggs and sperm into a bowl by hand to mix them. This combination of "medicine" and mimicking the ocean helps the fish do what they normally only do in the wild.

2. As per the industry scenario, what are the major technical constraints preventing Indian fish farmers from successfully breeding high-value species like catfishes and Murrels?

Major technical constraints include poor broodstock quality, lack of standardized induced breeding protocols, inadequate hatchery infrastructure, and limited technical skill among farmers. For species like catfishes and murrels, difficulties in hormone response, cannibalism in larvae (Murrels), and high larval mortality are major issues.

3. How can Indian hatcheries implement a cost-effective DNA marker-based pedigree system to mitigate inbreeding and enhance the production of high-value fish species?

Indian hatcheries can implement a cost-effective DNA marker-based pedigree system by focusing on microsatellite markers or low-density SNP panels for parentage assignment, using pooled larval rearing techniques, and utilizing public-private partnerships (like PMMSY) for training and, in some cases, outsourcing genotyping.



Malawi



A donut chart illustrating the gender distribution of respondents. The chart is divided into two segments: a large dark blue segment representing 71% for 'Male' and a smaller medium blue segment representing 29% for 'Female'. The labels and percentages are placed outside the chart near their respective segments.

Gender	Percentage
Male	71%
Female	29%

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2



Indoor Shrimp Farming



22-01-2026

Recent Initiatives on Indoor Shrimp Farming in India



Dr. K. Dinesh
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KUFOS, Kochi, Kerala
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Dr. Dinesh delivered a comprehensive and technically rich presentation on “Recent Initiatives in Indoor Shrimp Farming in India”, highlighted the shift from traditional open pond system to controlled indoor environment amid challenges like climate variability, disease outbreaks and biosecurity risks

He began with the description of global shrimp production. He highlighted that brackish water aquaculture using salinity of 5-25ppt dominates for shrimp farming. He highlighted that there is a huge opportunity for shrimp farming in the saline areas of North India, specifically in **Haryana and Punjab**.

System Design and Rearing Strategy

Indoor shrimp farming's multi-phase rearing uses compact, high-density nursery stages to build robust post-larvae before grow-out, maximizing survival and uniformity in controlled round tanks.

1

Acquire PL7-8 post larvae from hatcheries
(younger for easier transport, up to 2,000 per 3L bag) reared in nursery phases

2

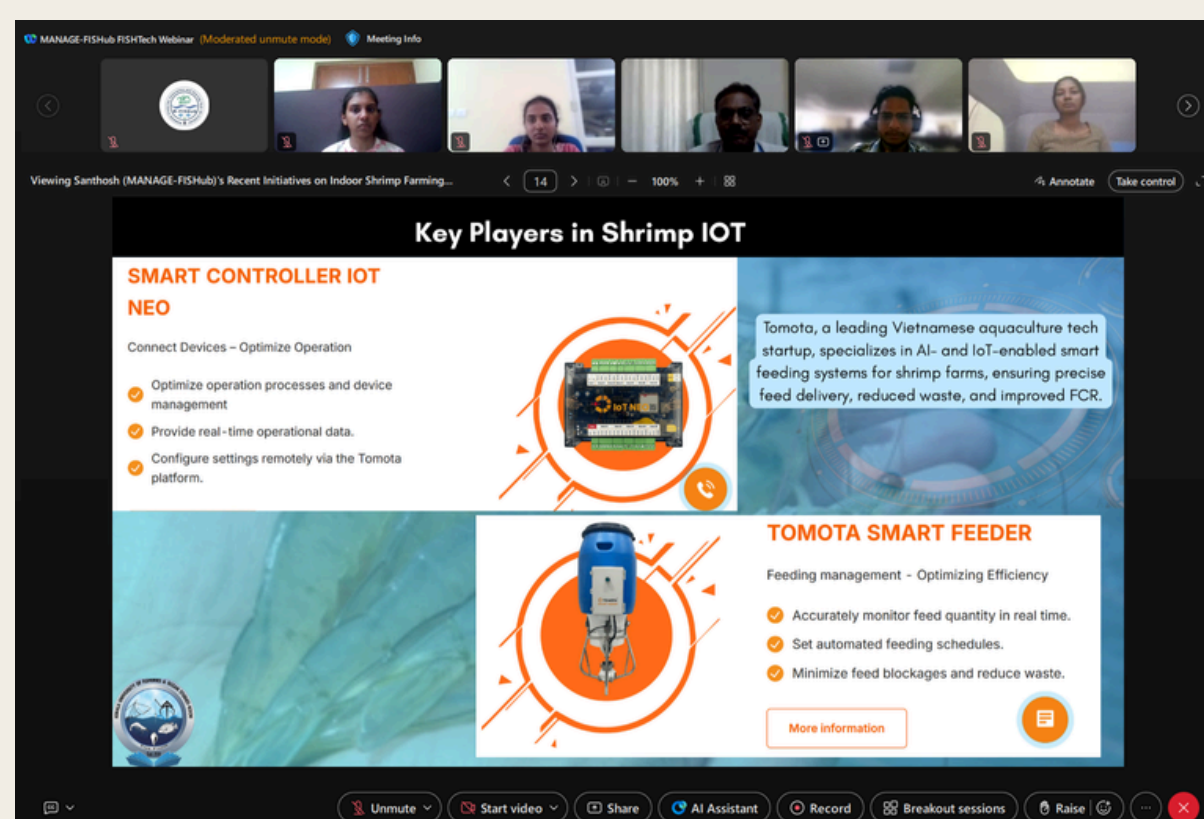
Nursery Phase - 1 (30 days)
Density: 1500-3000 PL/m³; Survival: 85-92%; Growth: 25-35%

3

Transitioned to grow out
Stocking density: 200-300/m³; Duration: 75-90days ; Target: 5-6kg/m³ biomass; FCR:1.1-1.3

Multi- Stage Rearing Strategy

Round tanks (up to 1,000 m³, 1.5m deep) with multi-level elevations (1ft differences for gravity drainage) are preferred, constructed using raised platforms, central drains, GI pipes, and 500-550 GSM silt volume sheets, often in diatom-based or fully shaded setups. Seawater (preferred for natural minerals) or brackish water (10-20 ppt, supplemented with bicarbonates) maintains alkalinity, crucial for molting crustaceans.



He highlighted the key technologies in indoor shrimp farming such as

1 Recirculating Aquaculture Systems (RAS)

2 Biofloc and Semi Biofloc

3 AI and IoT Sensors

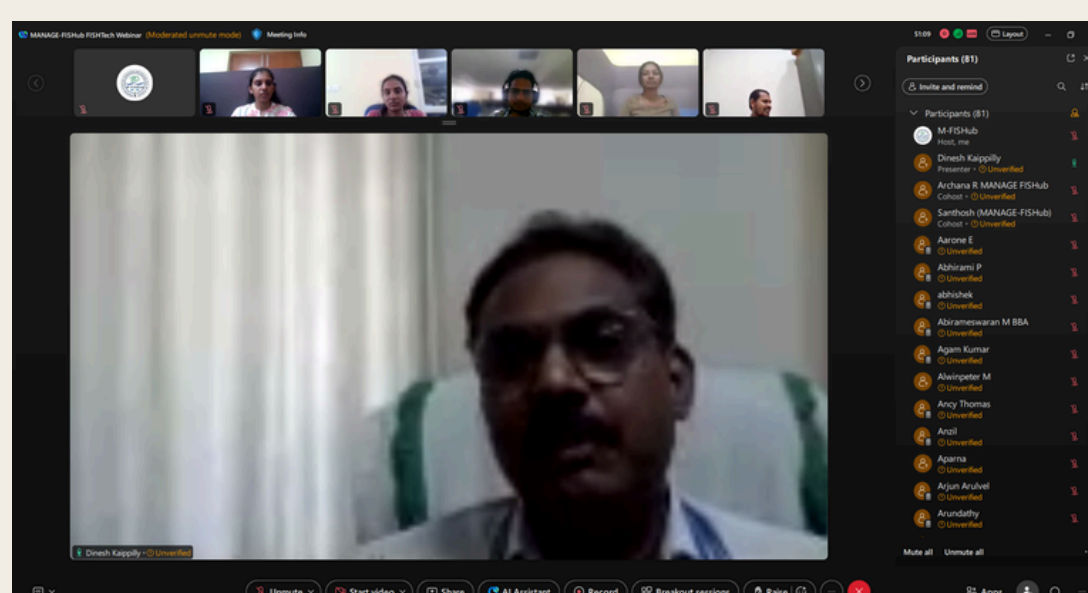
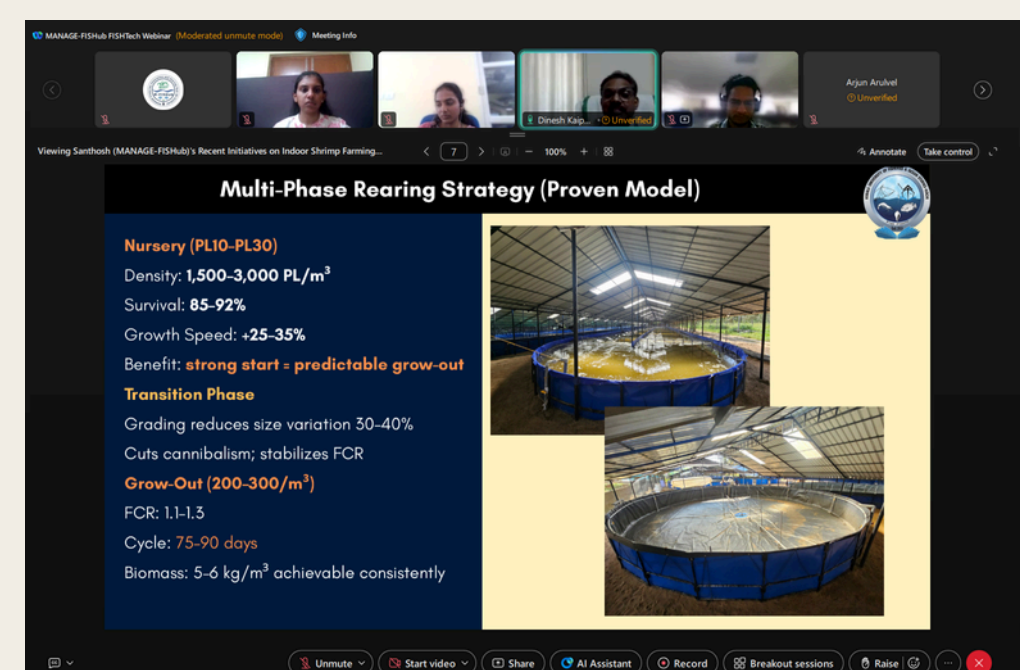
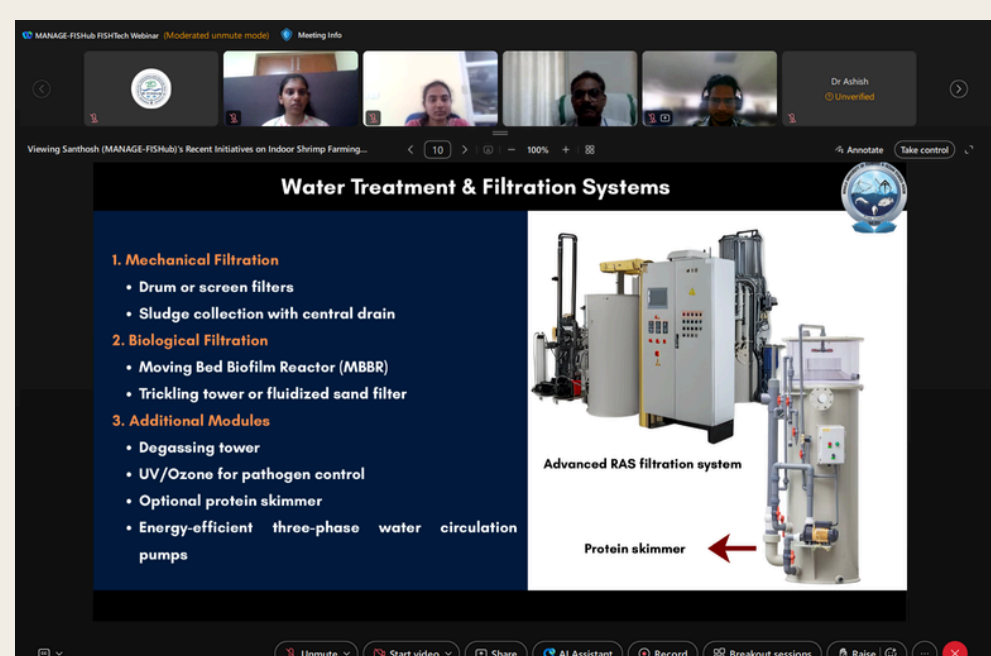
4 Smart Feeding

These technologies addressed the financial viability for entrepreneurs. He noted that under operational conditions, the cost of production is estimated between ₹160 and ₹210 per kg. A primary advantage of this system is market flexibility, allowing for a "year-round harvest" that can be timed to capitalize on seasonal demand surges. Shrimps produced indoors are "mud-free" and aesthetically superior, making them ideal for high-end urban supermarkets where they can fetch premium prices of ₹550 to ₹600 per kg, significantly higher than the ₹270 per kg typically seen in export-biased markets. By targeting these domestic urban centers, entrepreneurs can achieve a robust profit margin of approximately ₹100 per kg.

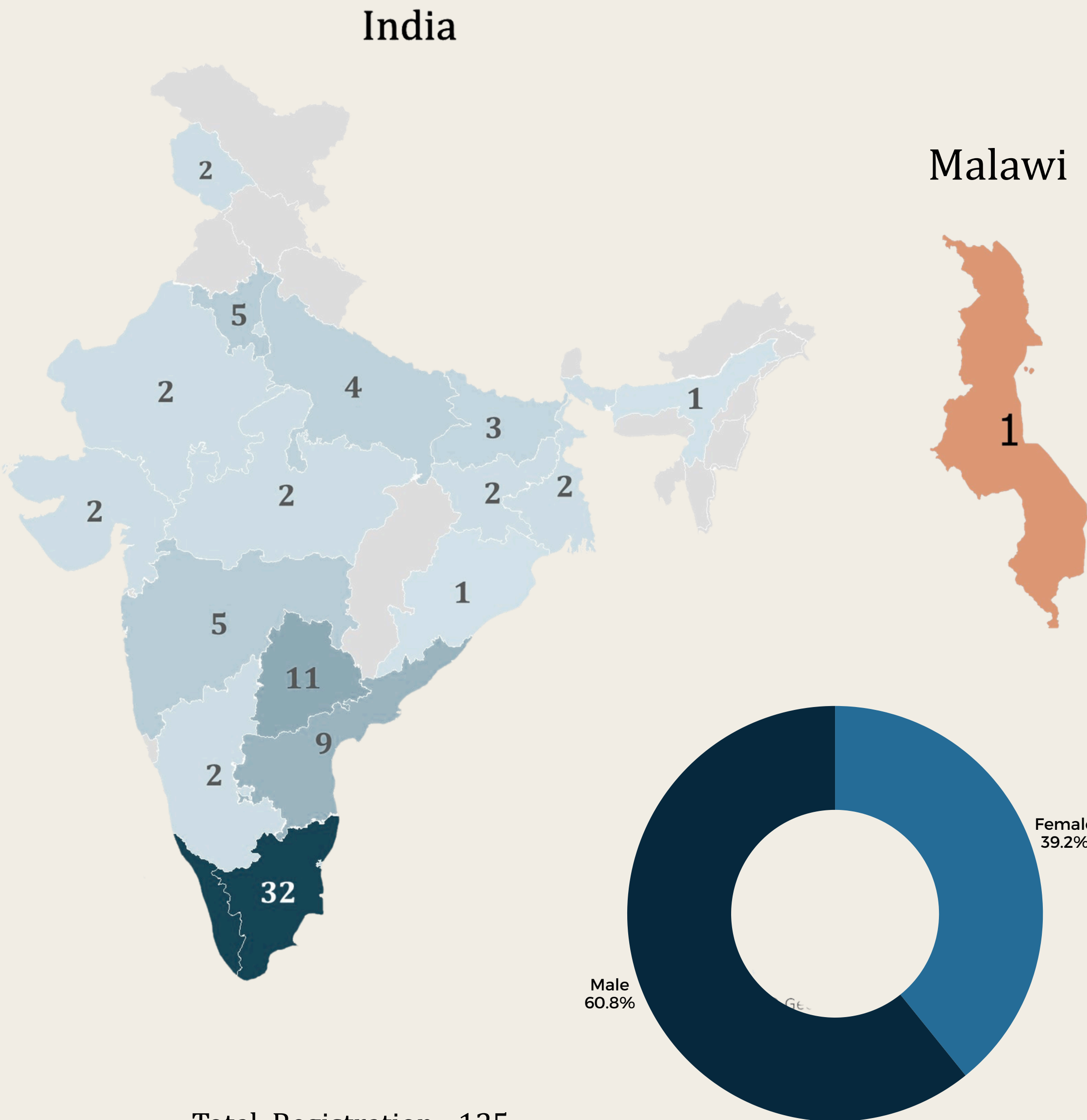
Q & A Session

1 Considering the present situation of high feed costs, seed prices, electricity expenses, probiotic usage, disease risks, and market fluctuations, what would be the actual cost of production per kilogram under an indoor culture system?

In today's market, the actual cost of production for indoor shrimp farming ranges from ₹200 to ₹265 per kg, depending on harvest size and density. Feed remains the largest expense (up to 50%), followed by high electricity costs for continuous aeration and rising prices for quality probiotics. While disease risks and seed prices add to the overhead, efficient management can maintain margins of 40%–50% if farm-gate prices remain stable. Consequently, profitability now depends heavily on achieving a low Feed Conversion Ratio (FCR) and utilizing solar subsidies to offset energy bills.



Participants Overview



Total Registration - 125
 (Male - 76; Female-49)
 Attended Participants - 90

YouTube Video Link: <https://www.youtube.com/watch?v=gGzNfApsbcl>

3



*Aqua Feed
Technology*

Recent Initiatives on Aqua Feed Technology



Dr. Chiranjiv Pradhan
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Dr. Chiranjiv highlighted the growing significance of aquaculture globally, noting that aquaculture production has surpassed capture fisheries and now contributes more than half of total aquatic animal production. He emphasized that such growth has been made possible largely due to advancements in aqua feed technology, which serves as a critical input in modern aquaculture systems.

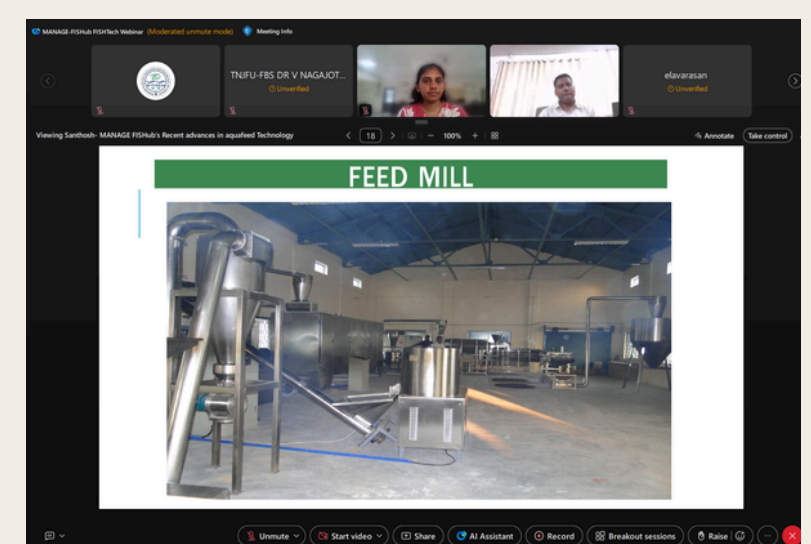
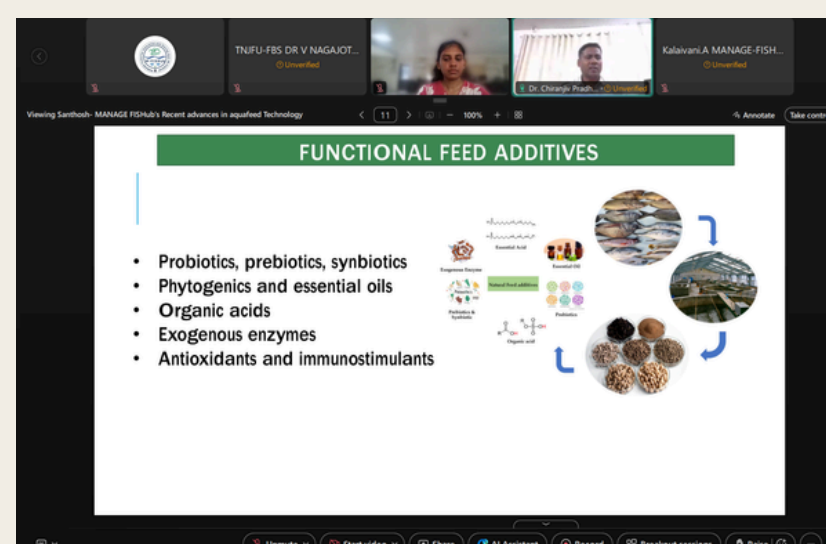
During the session, He elaborated on the Indian aquaculture scenario, pointing out that although India ranks second globally in aquaculture production, the feed-based sector still has immense scope for expansion. He discussed the evolution of aqua feed technology was explained from early wet and semi-moist feeds to modern dry and extruded feeds. Particular emphasis was placed on extrusion technology, which enables the production of floating and sinking pellets with improved digestibility, enhanced nutrient retention, better water stability, and improved feed conversion efficiency.

Modern formulations utilize various plant-based byproducts, such as oil cakes (soybean, sunflower, groundnut), and aquatic weeds like Azolla. Novel and sustainable ingredients are also gaining traction, including:

- **Insect meal:** Particularly Black soldier Fly larvae, which are protein-rich and utilize organic waste
- **Single cell proteins:** Microbes like Spirulina, algae, agro-industry by products, fish processing waste and yeast
- **Functional Additives:** Probiotics, prebiotics, and organic acids are now standard to enhance fish health and immunity.

He further emphasized the critical roles of protein, lipids, and carbohydrates in feed formulation, emphasizing amino acid balance, protein-to-energy ratio, and starch gelatinization for floating feed production.

He explained that functional additives such as probiotics, prebiotics, phytogenics, organic acids, enzymes, antioxidants, and immunostimulants, which enhance gut health, nutrient utilization, and disease resistance.



He explained how feed formulation has evolved beyond simple hand calculations to sophisticated linear programming and AI-based software to optimize costs and Feed Conversion Ratios (FCR).

He emphasized that primary leap in production technology is the shift from compressed pelleting to **extrusion technology**. Extrusion involves high-temperature, short-time processing (**125°C to 150°C**) that gelatinizes starch, improves digestibility, and allows for the creation of floating feeds. Modern production lines include several critical stages:

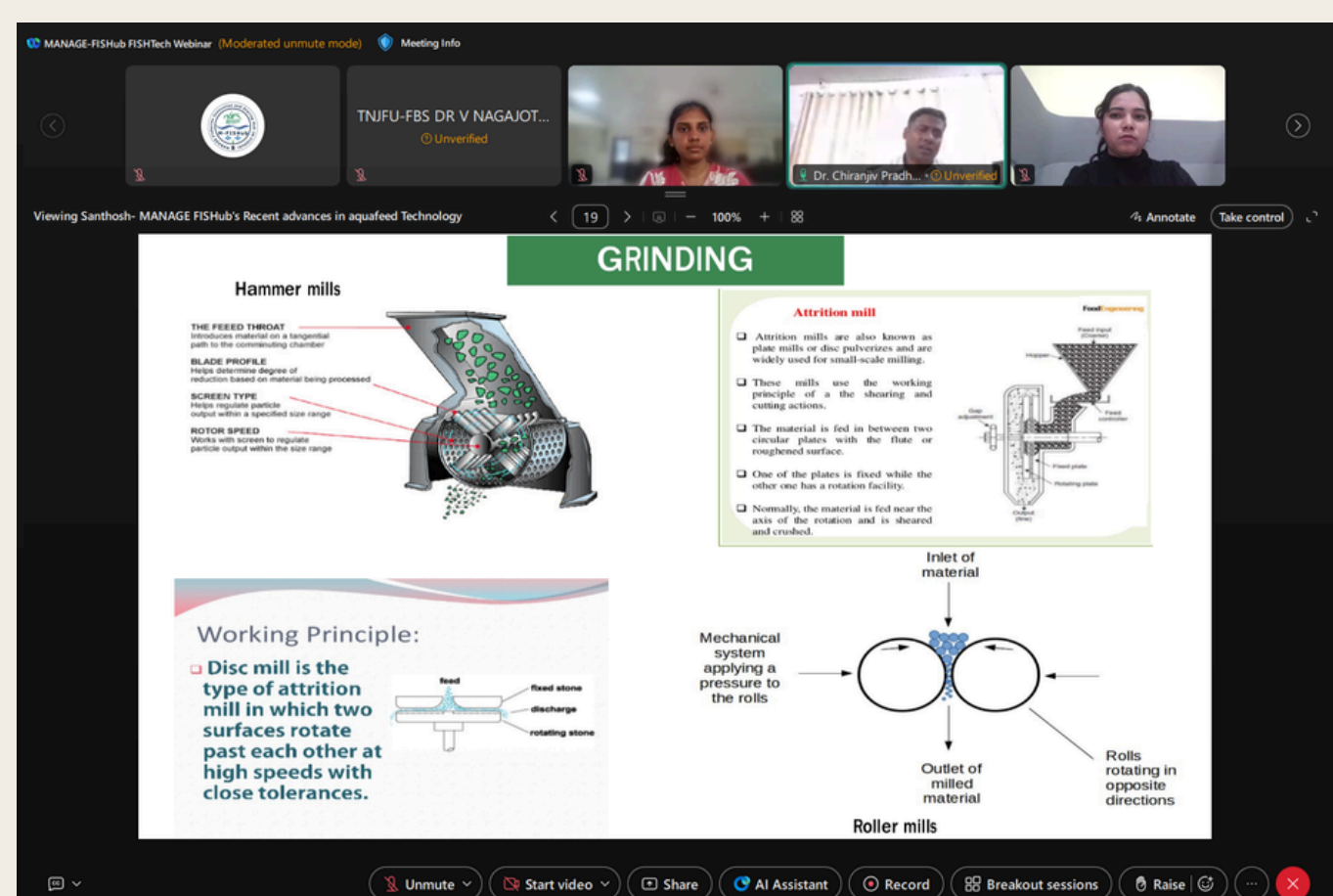
1. **Grinding:** Using hammer mills or advanced "multi-crackers" to achieve fine particle sizes (e.g., 200 microns for shrimp).
2. **Conditioning:** Applying steam to cook the mixture and reduce anti-nutritional factors.
3. **Extrusion:** Using twin-screw extruders for better shear force and product quality.
4. **Coating:** Applying heat-sensitive oils or bioactive compounds via vacuum coating after the pellets are dried.



Precision feed formulation techniques, including digestible nutrient concepts, life-stage specific feeds, software-based formulation tools, and the emerging use of artificial intelligence, were discussed as transformative approaches in feed manufacturing.

These various stages of feed production, stressing the importance of moisture control, ventilation, and quality management to prevent spoilage and nutrient loss.

In conclusion, he provided comprehensive knowledge on technological innovations, sustainability practices, and climate-smart approaches in aqua feed production. It underscored the need for environmentally responsible feed formulation through balanced amino acids, improved phosphorus utilization, circular bioeconomy practices, and reduced carbon footprint.





Q & A Session

1 What is the role of amino acids in Aqua feed?

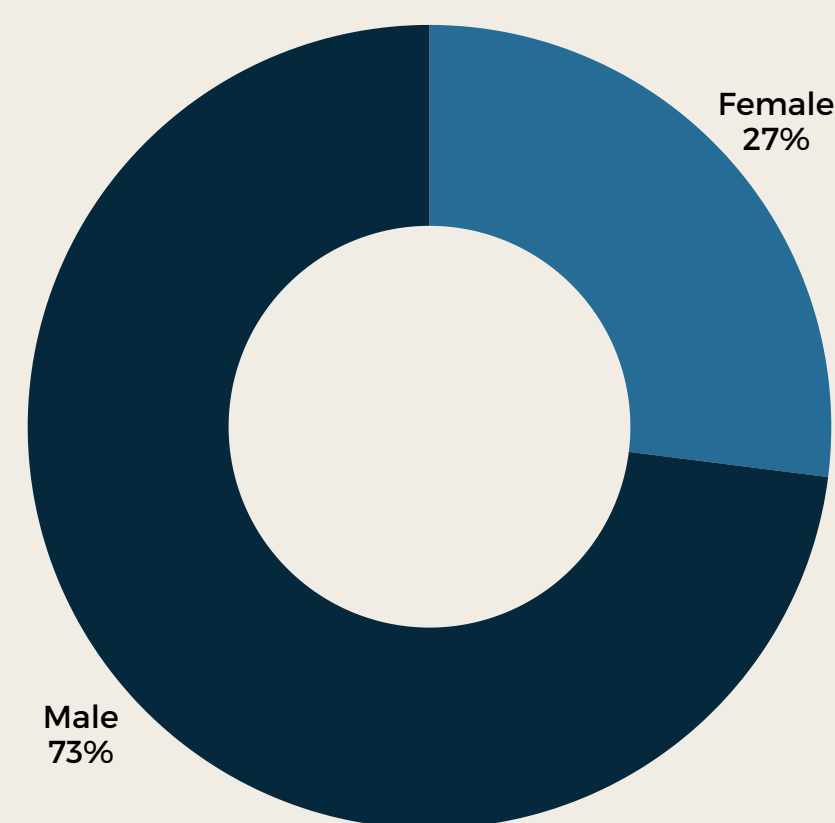
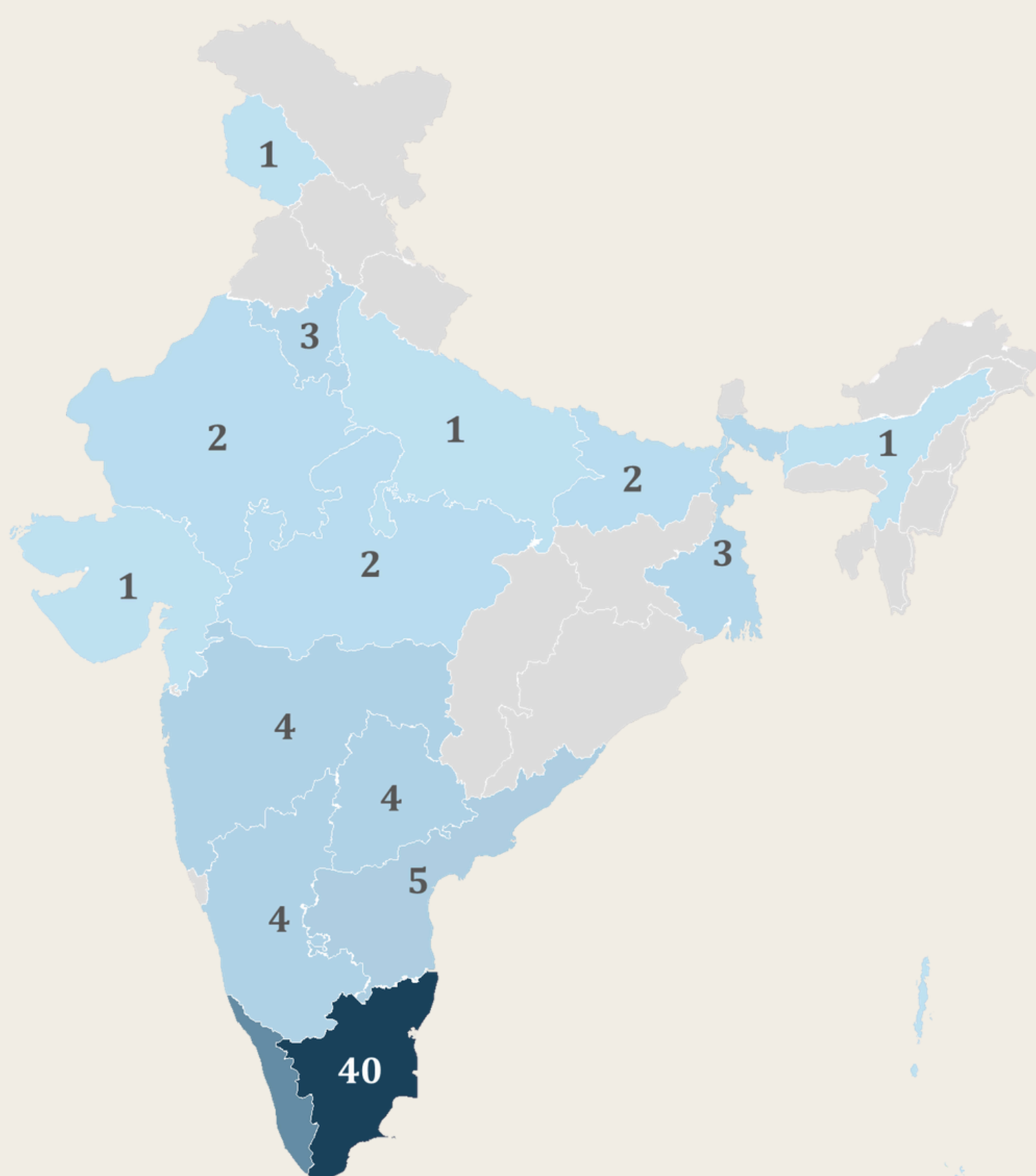
Amino acids are the building blocks of proteins and play a crucial role in aqua feed by supporting growth, muscle development, enzyme and hormone production, and immune function in fish and shrimp. Essential amino acids such as lysine and methionine must be supplied through feed to ensure proper growth, improved feed conversion ratio (FCR), better disease resistance, and efficient protein utilization. A balanced amino acid profile also reduces nitrogen waste, making aquaculture production more sustainable and cost-effective, especially in intensive and indoor farming systems.

2 Is there any AI model available for precision feed formulation?

Yes — there are AI-based models and software tools available for precision feed formulation. These systems use machine learning, optimization algorithms, and nutrition databases to predict the best combination of ingredients that meet specific nutrient requirements (like amino acids, energy, minerals) at minimum cost while considering species, life stage, and production conditions. Such AI-driven solutions help nutritionists optimize feed efficiency, reduce waste, and improve growth performance in aquaculture and livestock production.

Participants Overview

India



Total Registration - 100
(Male - 73; Female-27)
Attended Participants - 85

YouTube Video Link: <https://www.youtube.com/watch?v=V1UdGN58-IE&t=3s>

4



*Bioactive
Peptide*

Bioactive Peptide Production from Fish Waste



Dr. Ravi Baraiya
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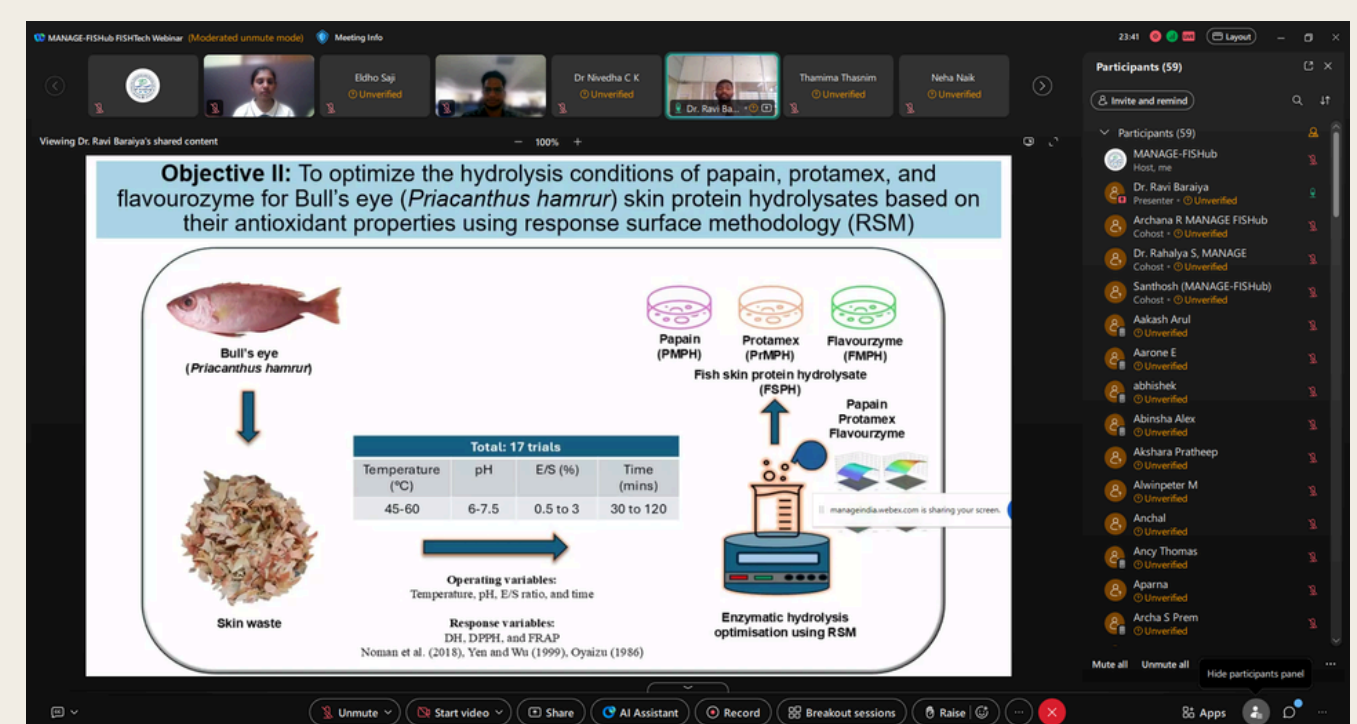
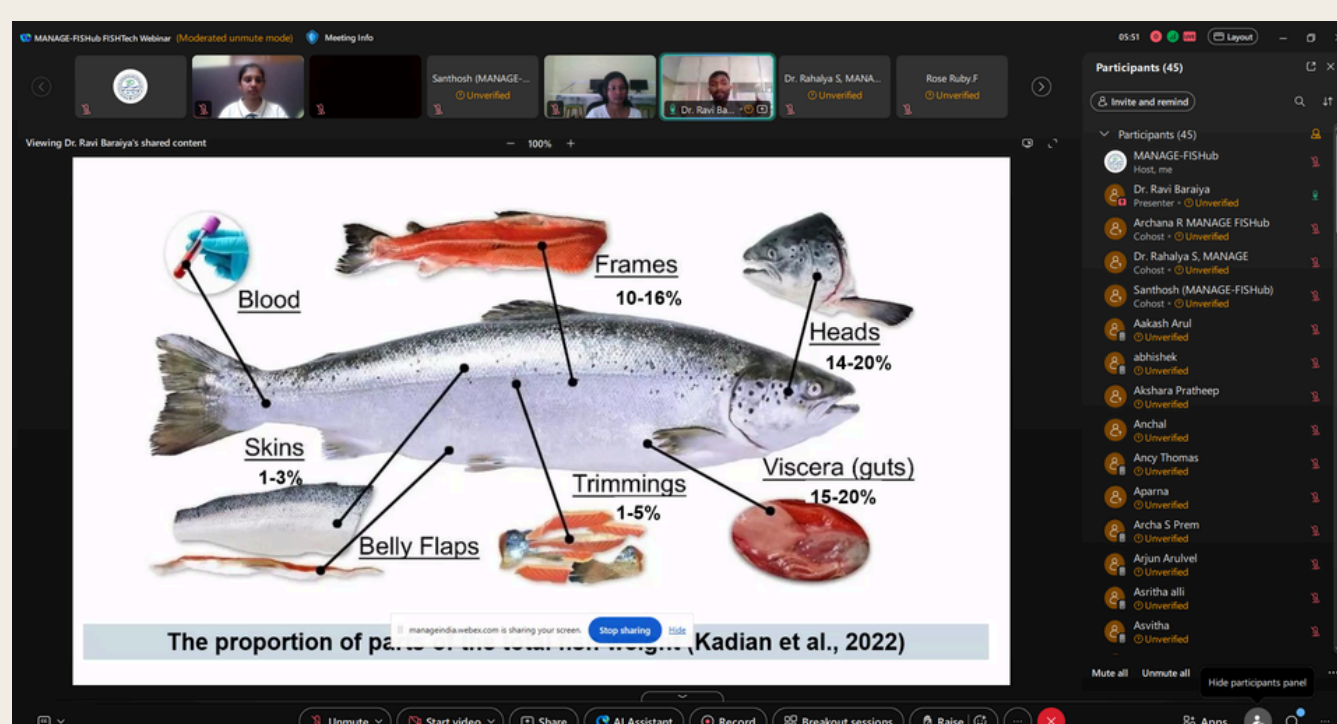
Dr. Ravi Baraiya focused on the sustainable transformation of fish processing waste into high-value bioactive peptides, highlighting a path from "waste to wealth" that supports the circular economy and addresses global health challenges.

While India is a global leader in fish production, nearly 50% to 60% of the total fish weight is often discarded as non-edible waste during processing. This includes skins, bones, viscera (guts), and heads. If not managed properly, this waste causes significant environmental pollution and economic loss. However, these by-products are actually rich in valuable biomolecules like proteins, lipids, and minerals.

He discussed on bioactive peptides are short chains of amino acids (usually 2 to 20 units) that remain inactive within the parent protein but provide health benefits once released through a process called hydrolysis. These peptides are highly soluble and stable, making them ideal for use in food, medicine, and cosmetics.

Dr. Baraiya explained a scientific workflow of production process of bio-peptides:

- Selection & Preparation: Using fish waste (like skin) as the base material.
- Enzymatic Hydrolysis: Breaking down proteins using specific enzymes (like papain or protamex). This method is preferred over chemical methods because it is safer and easier to control.
- Purification: Sorting the peptides by size and weight to find the most effective ones.
- Testing: Conducting laboratory and animal studies to ensure the peptides are safe and effective against diseases.



He emphasized that the global market for fish protein hydrolysates is growing steadily at a rate of 4.8%. Currently, many countries like the US, Japan, and the UK have commercialized these peptides as nutraceuticals (health supplements), but India has yet to fully tap into this market. Innovators are encouraged to overcome challenges like the bitter taste of peptides through techniques like encapsulation (masking the flavor) to create health drinks, creams, and functional food products.

Q & A Session

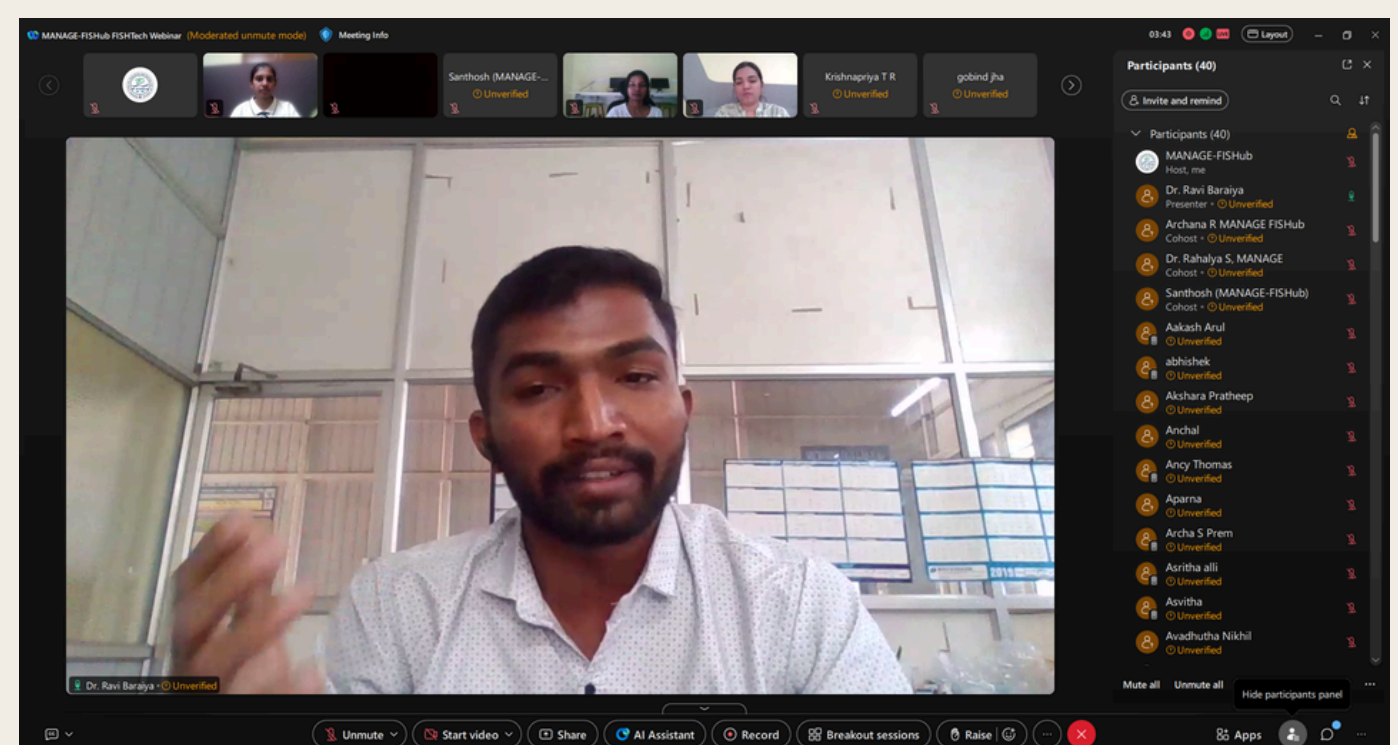
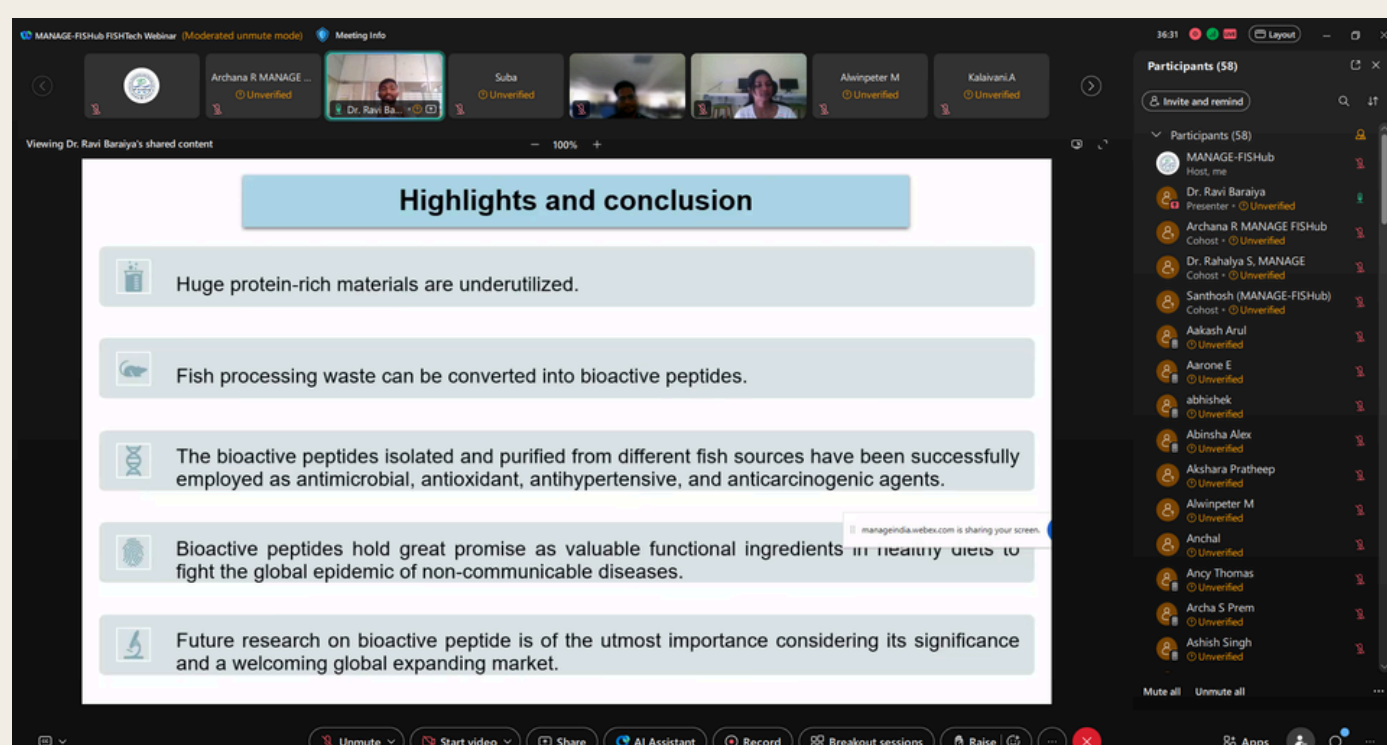
1 Is there any challenges to maintain quality while producing bioactive peptides from fish waste?

Maintaining quality while producing bioactive peptides from fish waste is challenging due to the high variability of raw materials, as protein content and amino acid profiles fluctuate significantly based on fish species, age, and seasonal factors. The production process, typically involving enzymatic hydrolysis, requires extremely precise control over temperature, pH, and time; even minor deviations can alter peptide length and bioactivity, leading to inconsistent batches. Additionally, manufacturers face sensory and safety hurdles, such as the development of bitter tastes from hydrophobic amino acids and the risk of contamination from heavy metals, biogenic amines (like histamine), or microbial spoilage if the waste is not handled with strict post-harvest care.

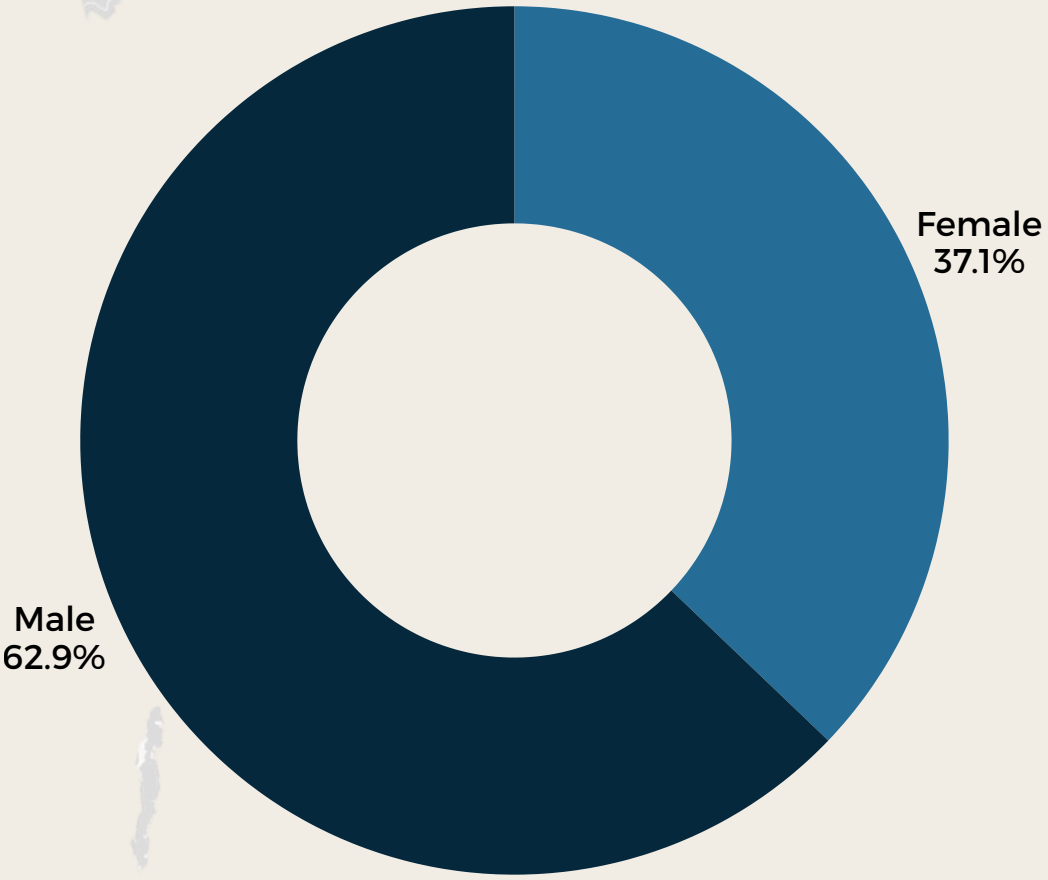
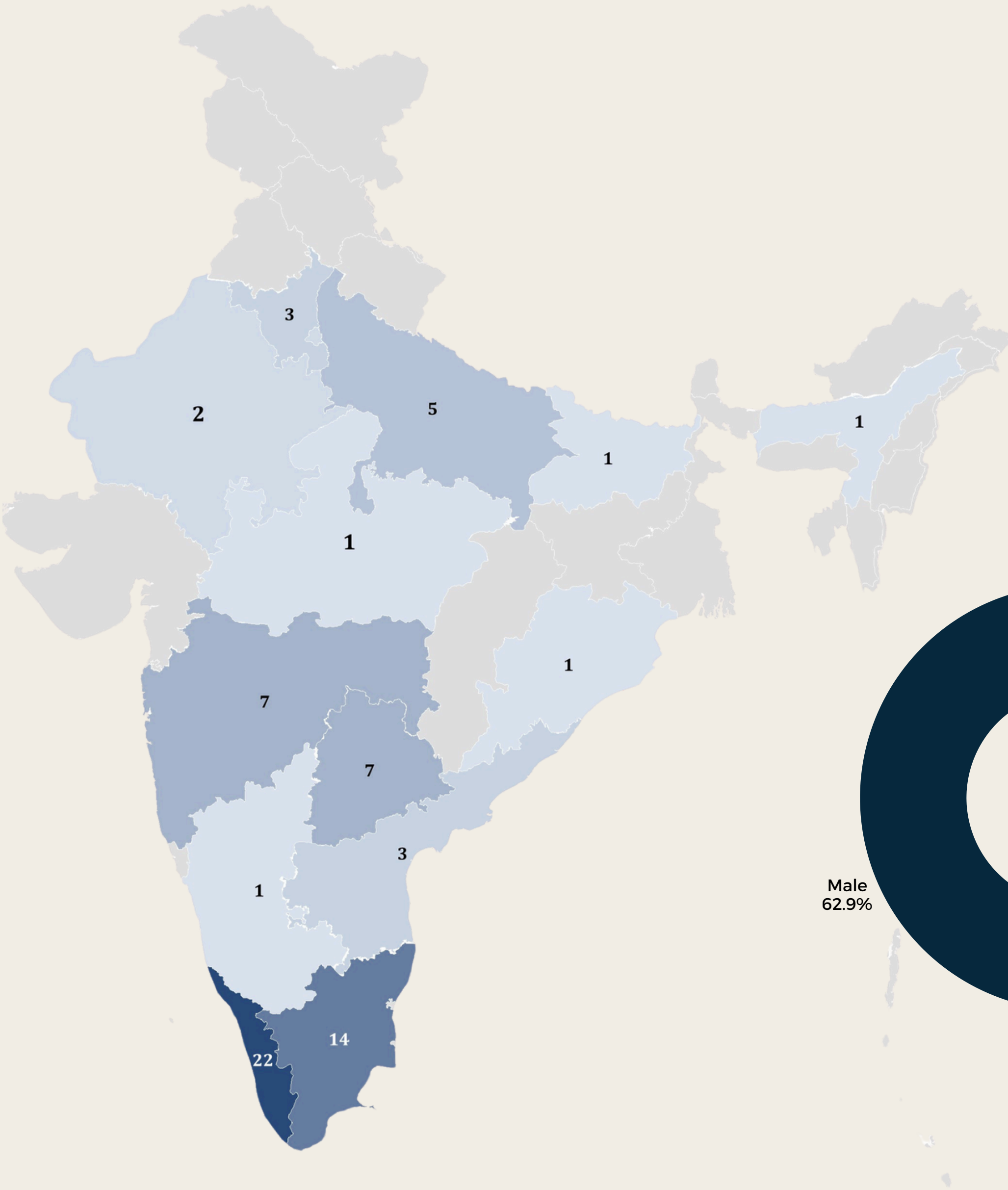
2 Which fish is suited for fish waste utilization?

While most aquatic species can be used for waste utilization, the following fish are particularly suited for producing high-quality bioactive peptides due to their high protein content in by-products and well-documented bioactivities such as Tuna, Salmon, Cod, Sardines and Tilapia.

Regardless of the fish species, fish processing is the critical factor in producing and maintaining the quality of bioactive peptides. While the specific fish provides the starting amino acid "blueprint," the processing steps determine whether those proteins are successfully released and remain functional.



Participants Overview



Total Registration - 70
 (Male - 44; Female-26)
 Attended Participants - 50

YouTube Video Link: https://www.youtube.com/watch?v=_D98_khdxGA&t=2558s

5



*Seaweed Value
Products*

Seaweed Value Added Products



Dr. Radhika Rajashree S. R

Dean,

Faculty of Ocean Science and

Technology

KUFOS, Kerala

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Dr. Radhika highlighted global and national seaweed landscape, nutritional profile and biological significance, commercial application and value addition, and government supports for entrepreneurs.

She highlighted that Seaweeds are recognized as a "**climate-smart crop**" that requires no fresh water or fertilizer while contributing nearly 50% of the world's oxygen and reducing eutrophication by absorbing nitrogen and phosphorus. Globally, the market is projected to reach \$44.56 billion by 2033. While Asia produces 97% of the world's seaweed dominated by China and Indonesia. In India, Tamil Nadu holds the highest diversity, followed by Gujarat, Maharashtra, and Kerala.

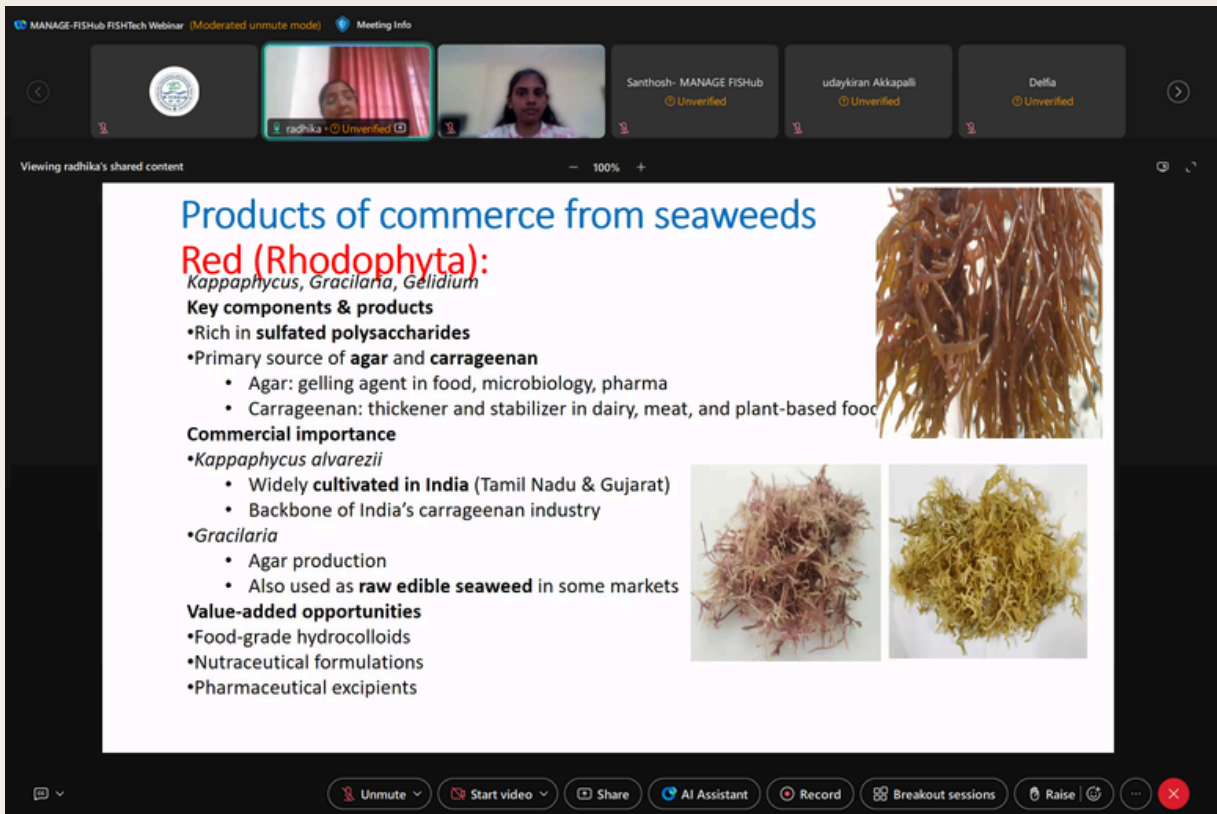
Dr. Radhika provided detailed insights into commercially important species such as

- **Kappaphycus (Red Seaweed)**- used as a thickening and stabilizing agent in dairy products, toothpaste, and cosmetics.
- **Gracilaria (Red Seaweed)** - used as a major source of agar
- **Sargassum (Brown Seaweed)** - used for the extraction of alginates (alginic acid), used in textile printing, paper coating, and wound dressings.
- **Ulva (Green Seaweed)** - Widely consumed as a human food.

Notably, certain species like Porphyra offer protein levels comparable to eggs and soybeans, while others are rich in Vitamin B12, making them vital for vegan diets. Their bioactive properties include anti-cancer, neuroprotective, antioxidant, and immunomodulatory effects.

She described the complete seaweed value chain from site selection, seed material management and cultivation practices such as raft, rope and tube net methods. She explained the primary and secondary processing.

Primary Processing	Secondary Processing
• Washing • Drying • Grading • Storage	• Enzyme-assisted extraction • Ultrasound Extraction • Supercritical CO2 extraction



She highlighted numerous innovative value added products developed through research, including seaweed noodles, pasta, bread, biscuits, cookies, soup powders, coffee blends, yogurt, cheese, sausages, patties, surimi products, nutri bars, chocolates, jams, pickles, spices, and seasoning powders.

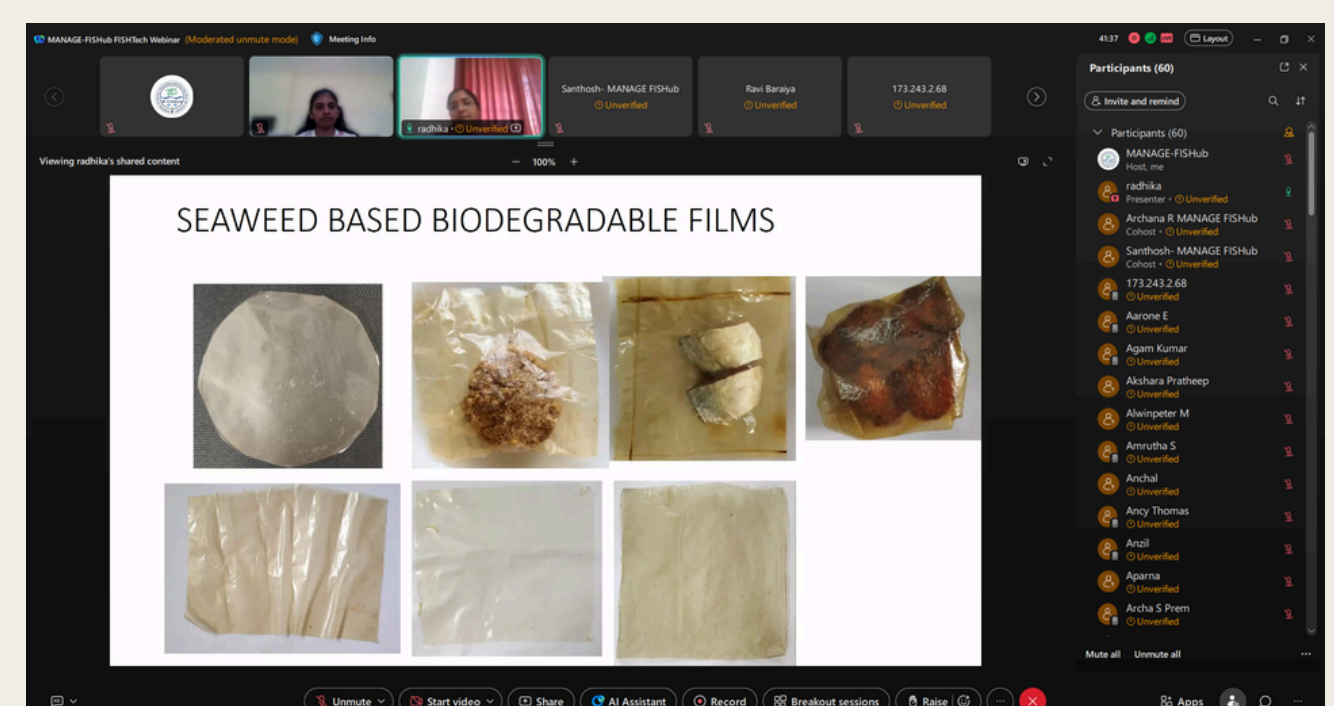
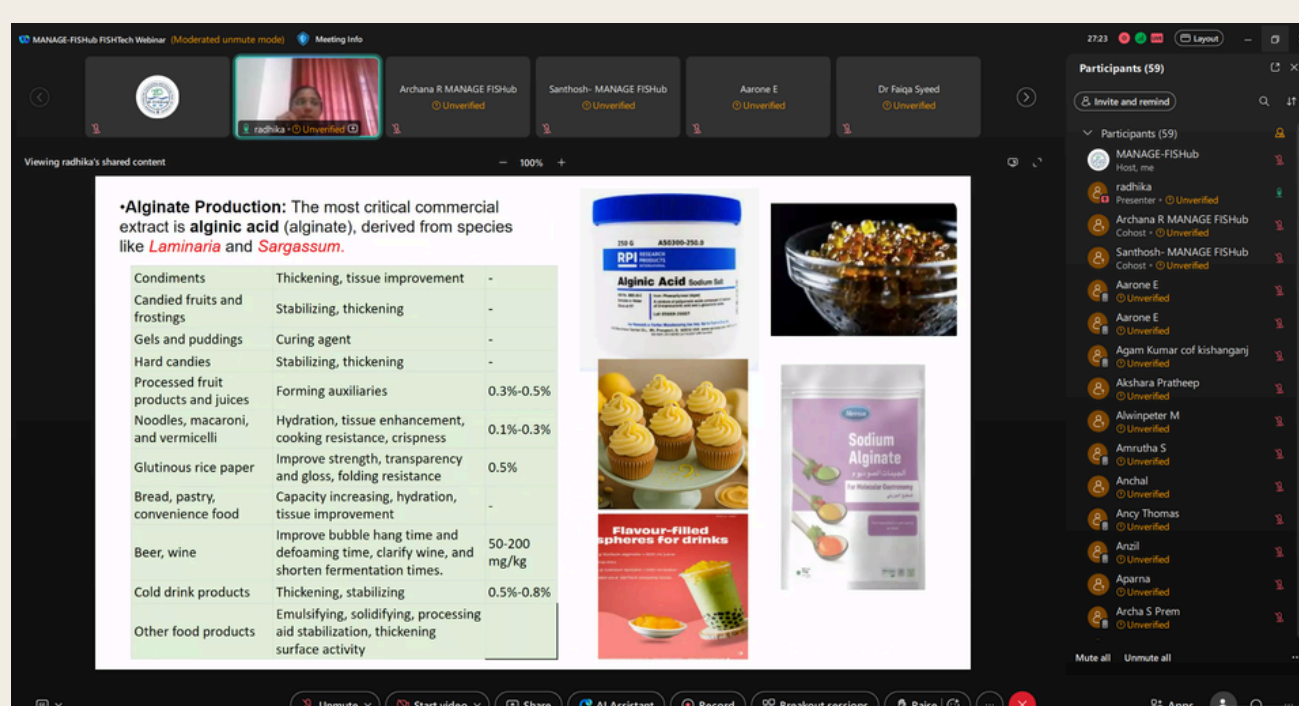
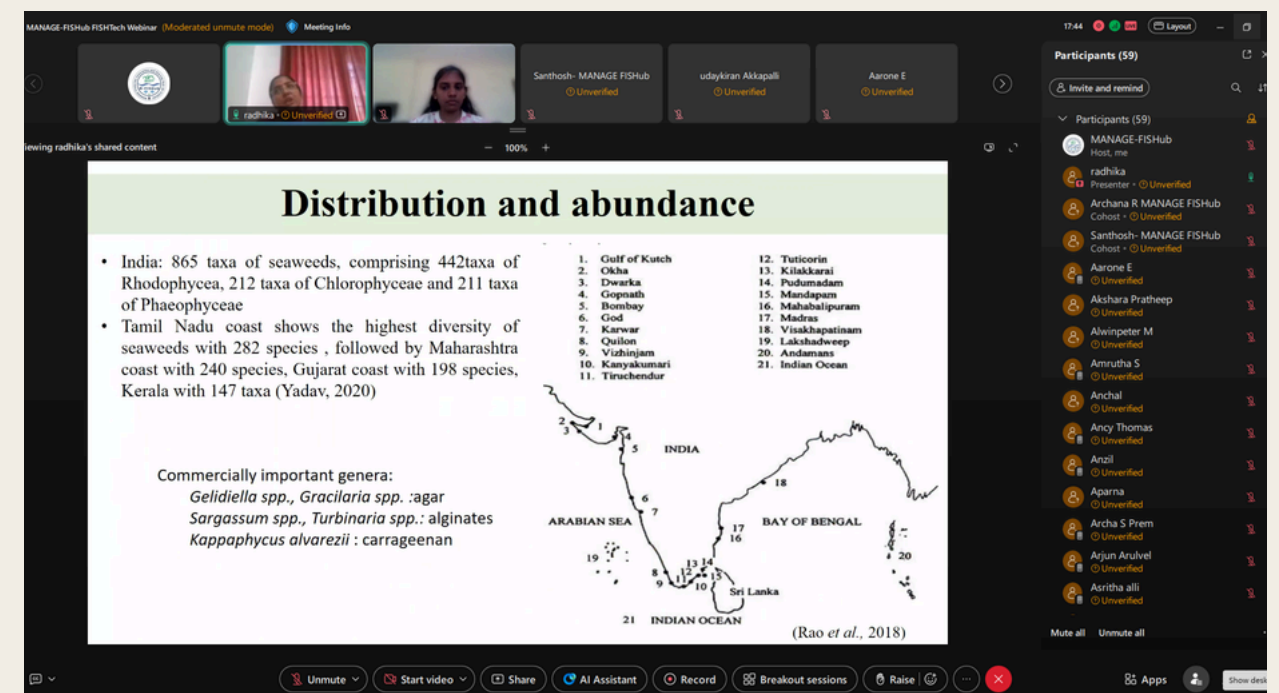
She also discussed seaweed-based biodegradable films, edible coatings, nanocomposites, and packaging materials, highlighting their potential in extending shelf life and supporting sustainable alternatives to plastics. Additionally, seaweeds were presented as biofertilizers, animal feed supplements, mineral sources, and biofuel substrates, reinforcing their multipurpose utility.

Despite the vast opportunities, Dr. Radhika addressed major challenges such as

- Inconsistent raw material supply
- Monoculture dependency (particularly on Kappaphycus)
- Disease issues like ice-ice disease,
- Seasonal variability
- Climate impacts
- Lack of quality germplasm
- High sulfate content affecting gel strength
- Regulatory bottlenecks
- Leasing and sea-space allocation issues
- Market barriers due to unfamiliar taste
- Supply chain inefficiencies
- Limited advanced processing infrastructure

The session also highlighted government support mechanisms under PMMSY, including 40% subsidy for general beneficiaries and up to 60–100% subsidy for women, SC/ST groups, cooperatives, and specific regions like Lakshadweep. Seaweed clusters and parks are being developed in Tamil Nadu and other coastal states to strengthen cultivation, germplasm research, and value addition infrastructure.

The speaker concluded by emphasizing that seaweed-based entrepreneurship can significantly contribute to sustainable coastal livelihoods, women empowerment, export growth, and blue economy development in India.





Q & A Session

1 What is the maximum amount of subsidy provided to support fisheries enterprise?

Under the Pradhan Mantri Matsya Sampada Yojana (PMMSY) and its sub-scheme PM-MKSSY, the maximum subsidy for a fisheries enterprise depends on the category of the owner and the scale of the project. For beneficiary-oriented activities, the government provides financial assistance of up to 40% of the project cost for the General category and up to 60% for SC, ST, and Women categories. Specifically, under the performance grant for small enterprises, this translates to a maximum subsidy of ₹75 lakh for General category entrepreneurs and ₹100 lakh (₹1 crore) for SC, ST, or Women-owned enterprises. For larger group-based entities like FFPOs or cooperatives, the grant can reach a ceiling of ₹200 lakh (₹2 crore).

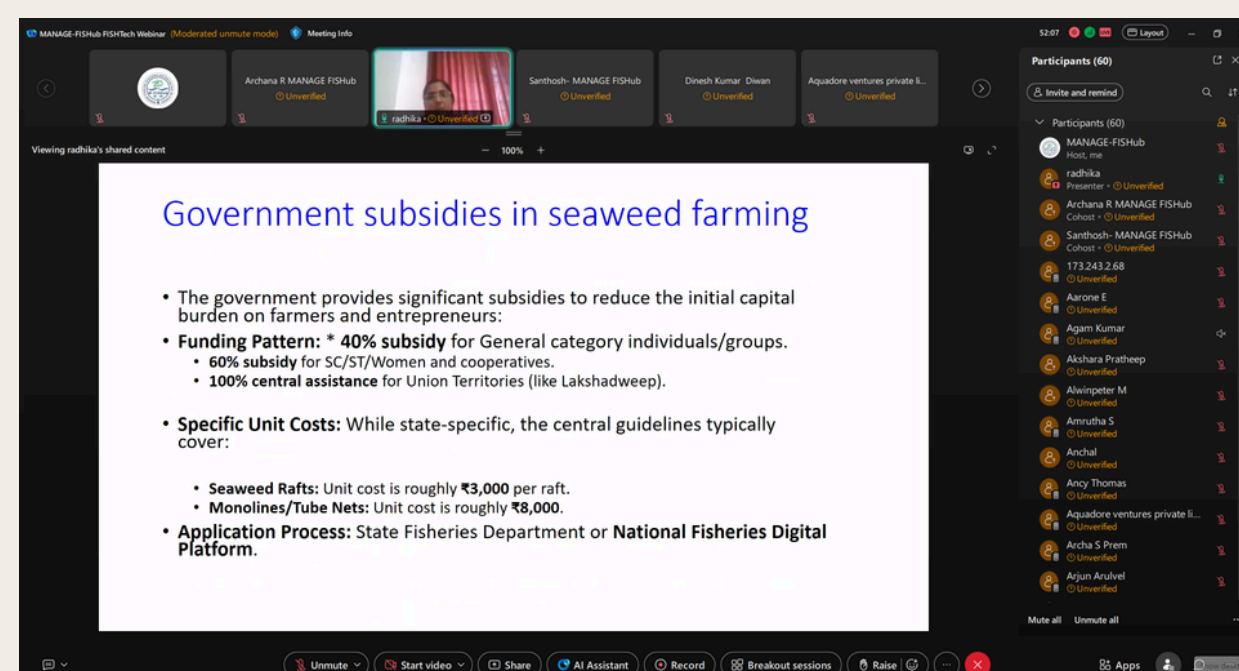
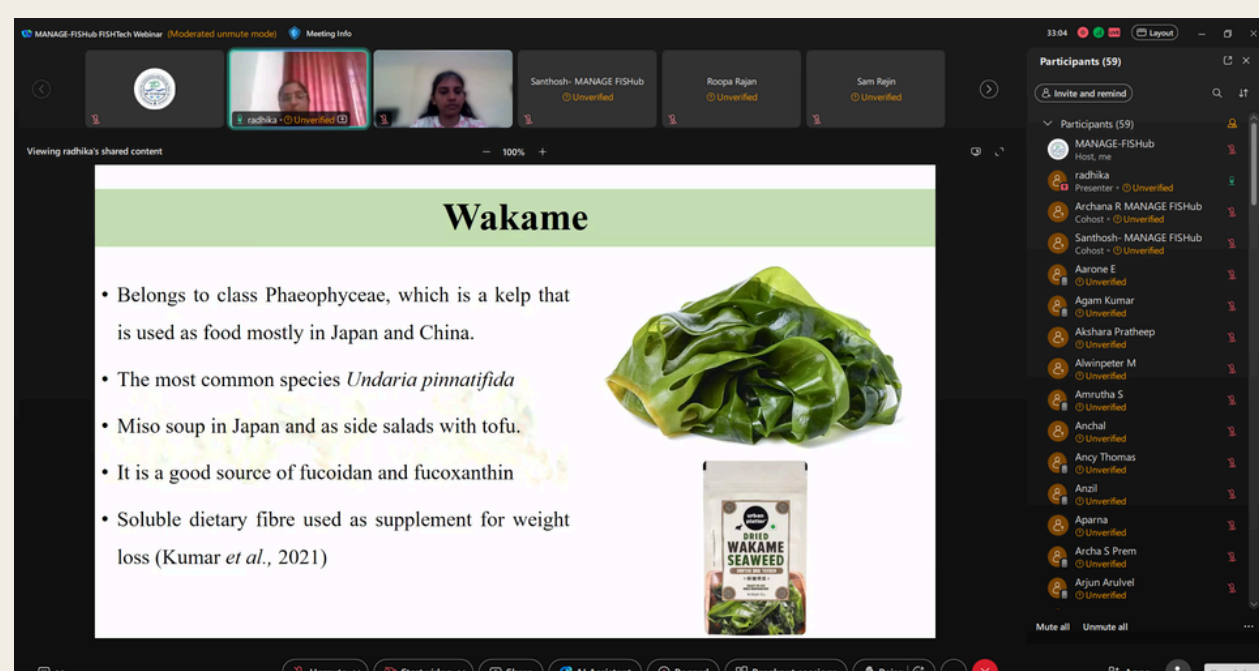
2 What entrepreneurial opportunities are there in seaweed cultivation?

Seaweed cultivation offers many entrepreneurial opportunities with low investment and good income potential. Entrepreneurs can start seaweed farming for food products, animal and fish feed, fertilizers, and raw material for pharmaceuticals and cosmetics. There are also opportunities in value addition such as making dried seaweed, seaweed powder, gels, bio-stimulants, and organic manure. Small startups can earn more by focusing on processing, packaging, branding, and direct marketing of seaweed products, while also supporting sustainable coastal livelihoods.

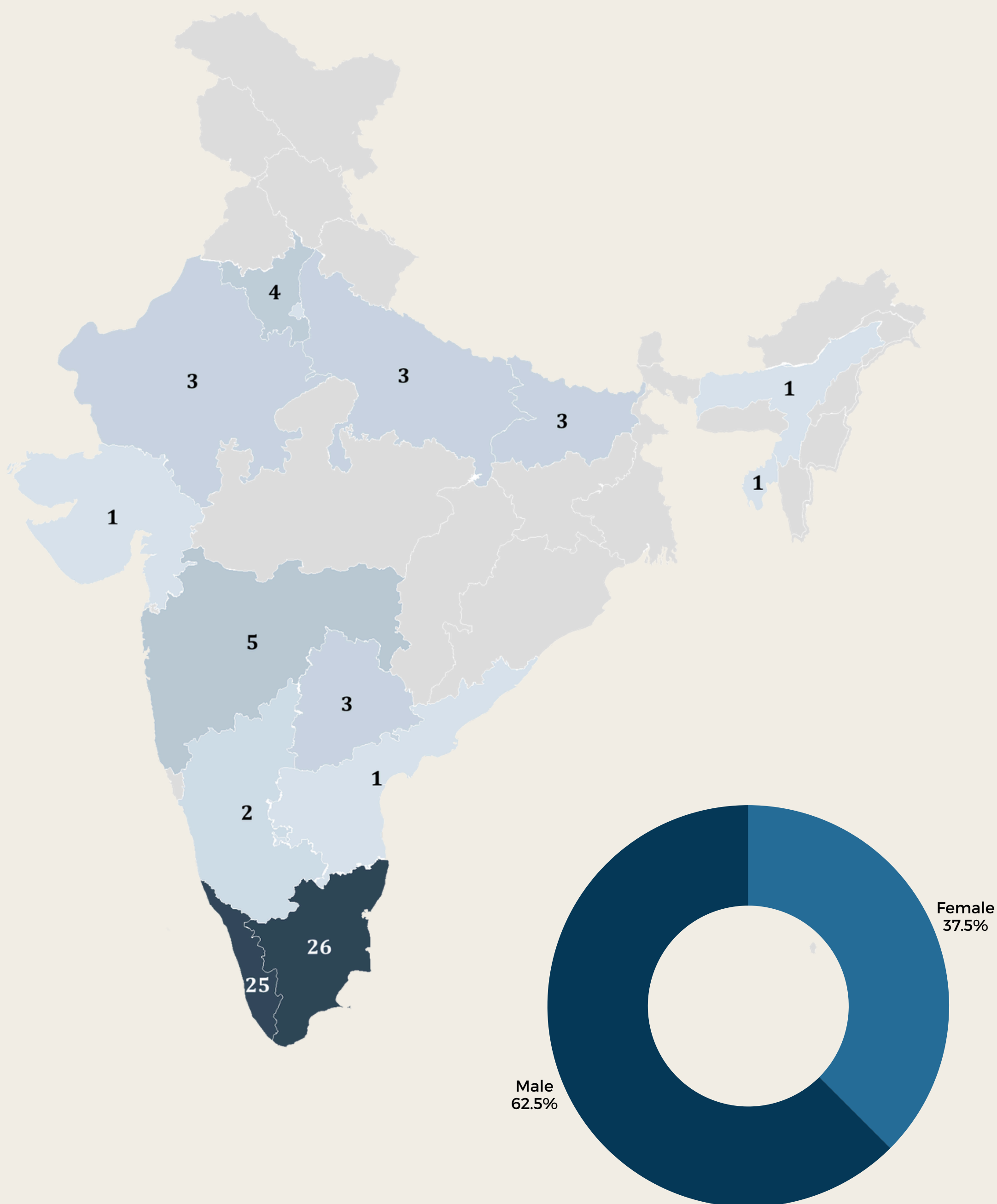
3 Is there any identification key or manual available to identify different types of seaweeds?

In India, research institutes like **ICAR-Central Marine Fisheries Research Institute (CMFRI)** and **Central Salt and Marine Chemicals Research Institute (CSMCRI)** have published manuals and field guides for seaweed identification. These manuals include classification based on color groups (green, brown, and red algae), morphological features (thallus structure, branching pattern, holdfast type), habitat, and reproductive structures.

Internationally, books such as Seaweeds of India and other regional seaweed floras are also used as reference materials for researchers, students, and entrepreneurs. Additionally, some universities and marine research organizations provide online identification guides and illustrated PDFs that help beginners easily recognize different species.



Participants Overview



Total Registration - 80
(Male - 50; Female-30)
Attended Participants - 60

YouTube Video Link: https://www.youtube.com/watch?v=cW-8igb_75Q

6



*Value Added
Fish Products*

Value Added Fish Products



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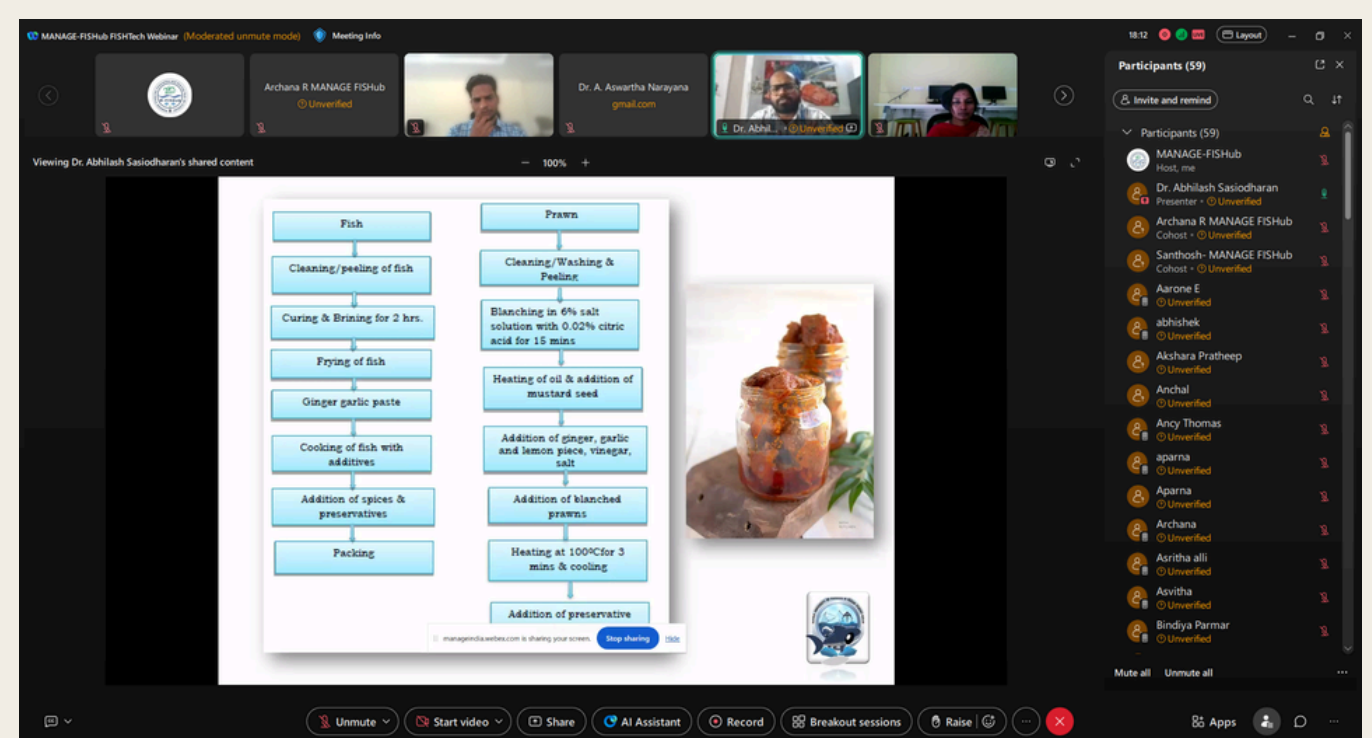
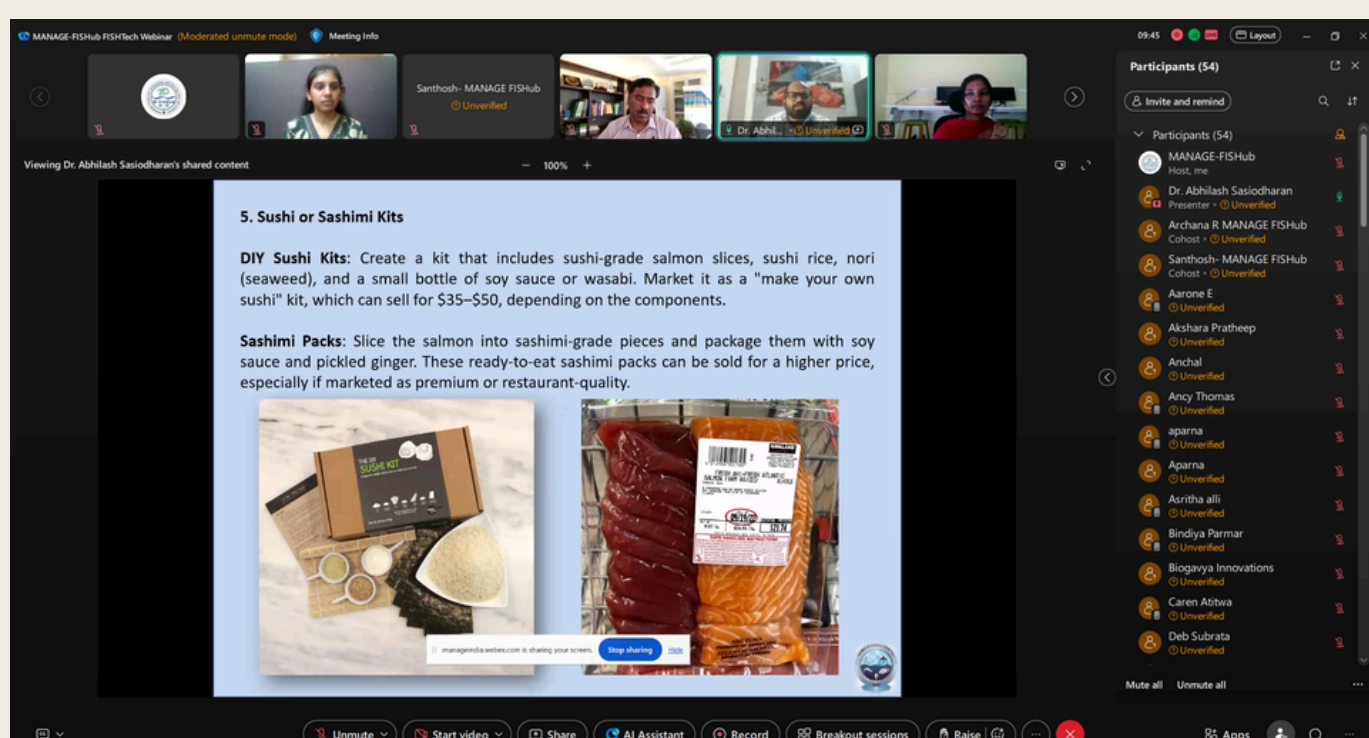
Dr. Abhilash Sasidharan delivered a comprehensive and industry-oriented presentation on **“Value-Added Fish Products”** emphasized the growing global significance of seafood processing in the context of rapid aquaculture expansion.

He emphasized that value addition refers to enhancing the economic worth of seafood by transforming raw materials into high-quality, processed goods. He illustrated this using salmon as an example, showing how basic portioning, marination, smoking, preparation of ready meals and simple interventions like proper packaging, labeling, portioning and canning can increase the original value of a product by \$20 to \$30. He emphasized that success in this sector depends on:

- **Raw Material Quality:** High-quality products can only be derived from fresh, high-standard raw materials.
- **Cold Chain Management:** Maintaining low temperatures (using ice or cold rooms) is essential to combat the high spoilage potential of seafood.

He provided technical insights into several commercially viable product categories:

1. Seafood Pickles: He explained ingredient composition, standardization parameters, and quality standards such as maintaining 60% solid content, 40% liquid content, pH between 4.0 and 4.5, and salt content within prescribed limits. Packaging options including glass jars, PET containers, laminated pouches, and automated filling systems were also discussed in relation to shelf life and market positioning.



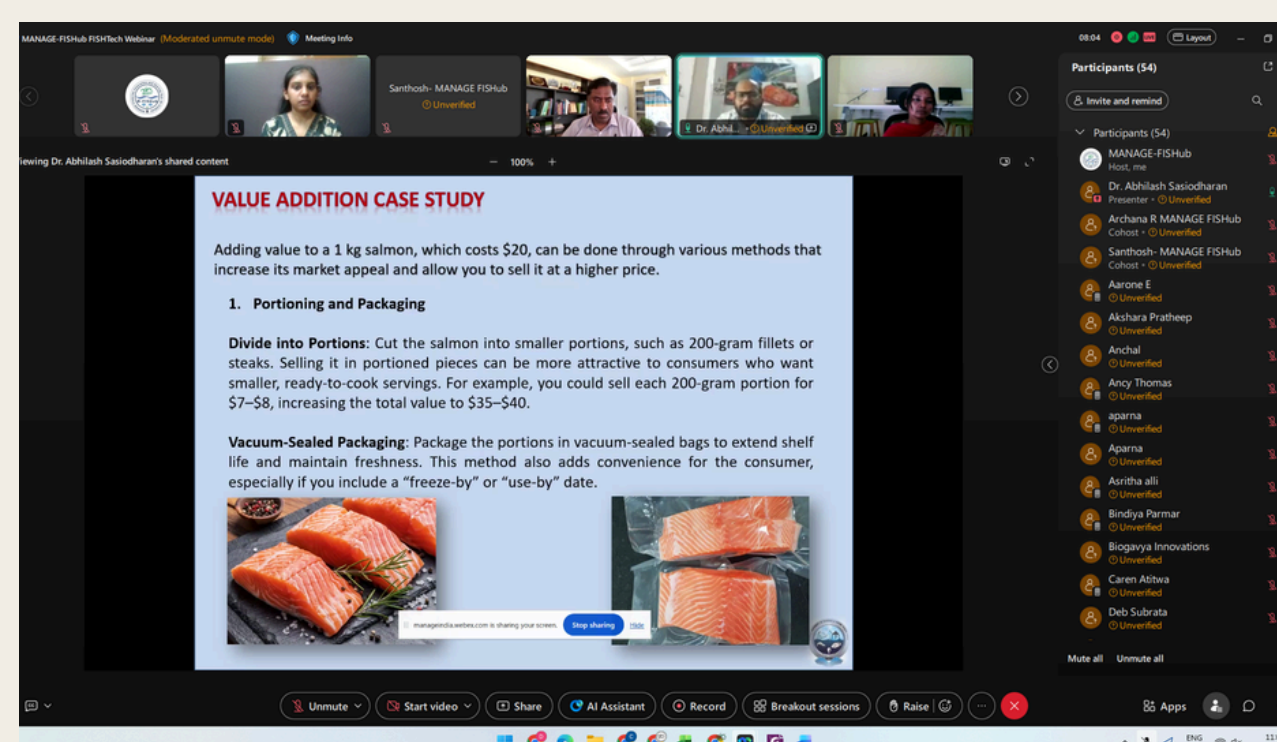
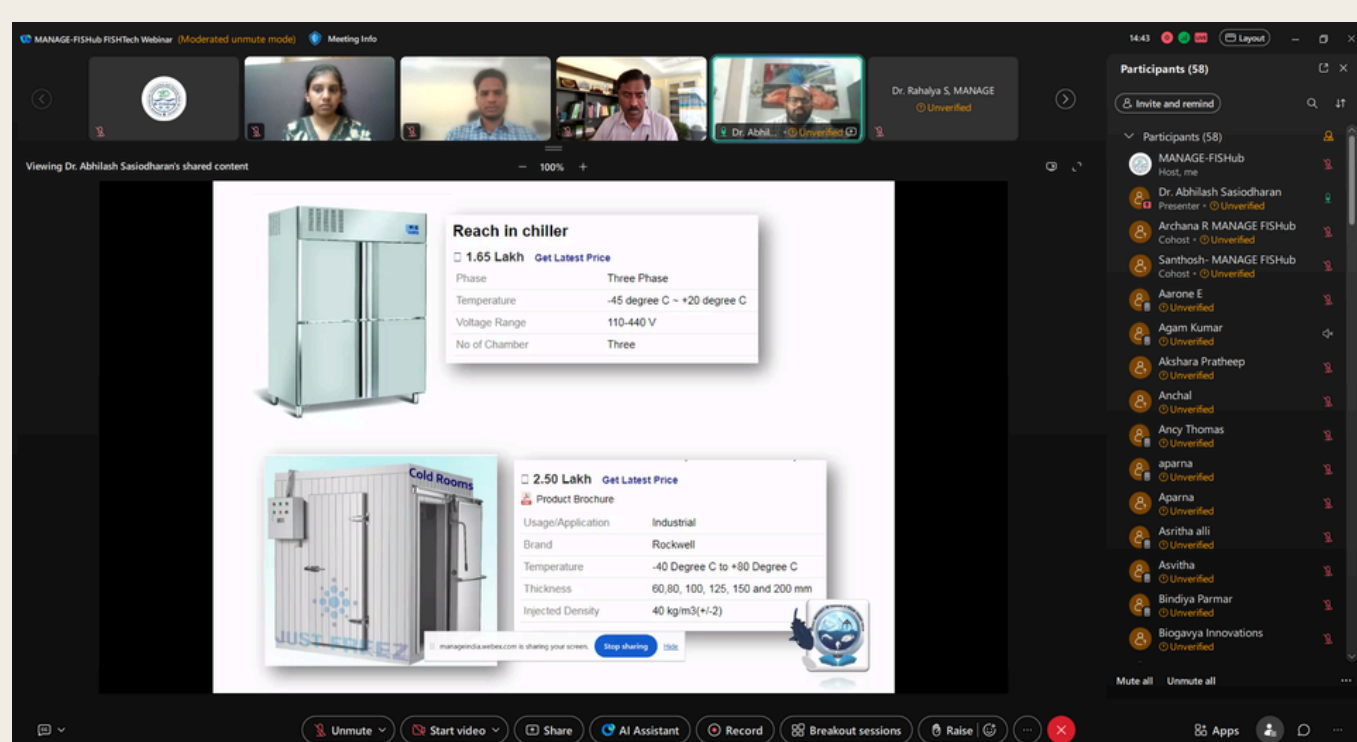
2. Battered and Breaded Products: The items such as cutlets, nuggets, patties, and fish fingers, highlighting the importance of forming, pre-dusting, battering, breading, and frying. Technical parameters such as batter viscosity, water-to-flour ratio, batter temperature (ideally below 15°C), coating percentage, and frying oil temperature were discussed in detail. Machinery such as forming machines, batter applicators, breading machines, and industrial fryers were introduced as scalable solutions for entrepreneurs.

3. Dried Fish: He emphasized moisture control (15–40%), salt concentration (5–30%), and minimal acid-insoluble ash to ensure product quality. Hygienic drying methods, including solar dryers, electric dryers, and hybrid systems, were highlighted as improvements over traditional open sun drying.

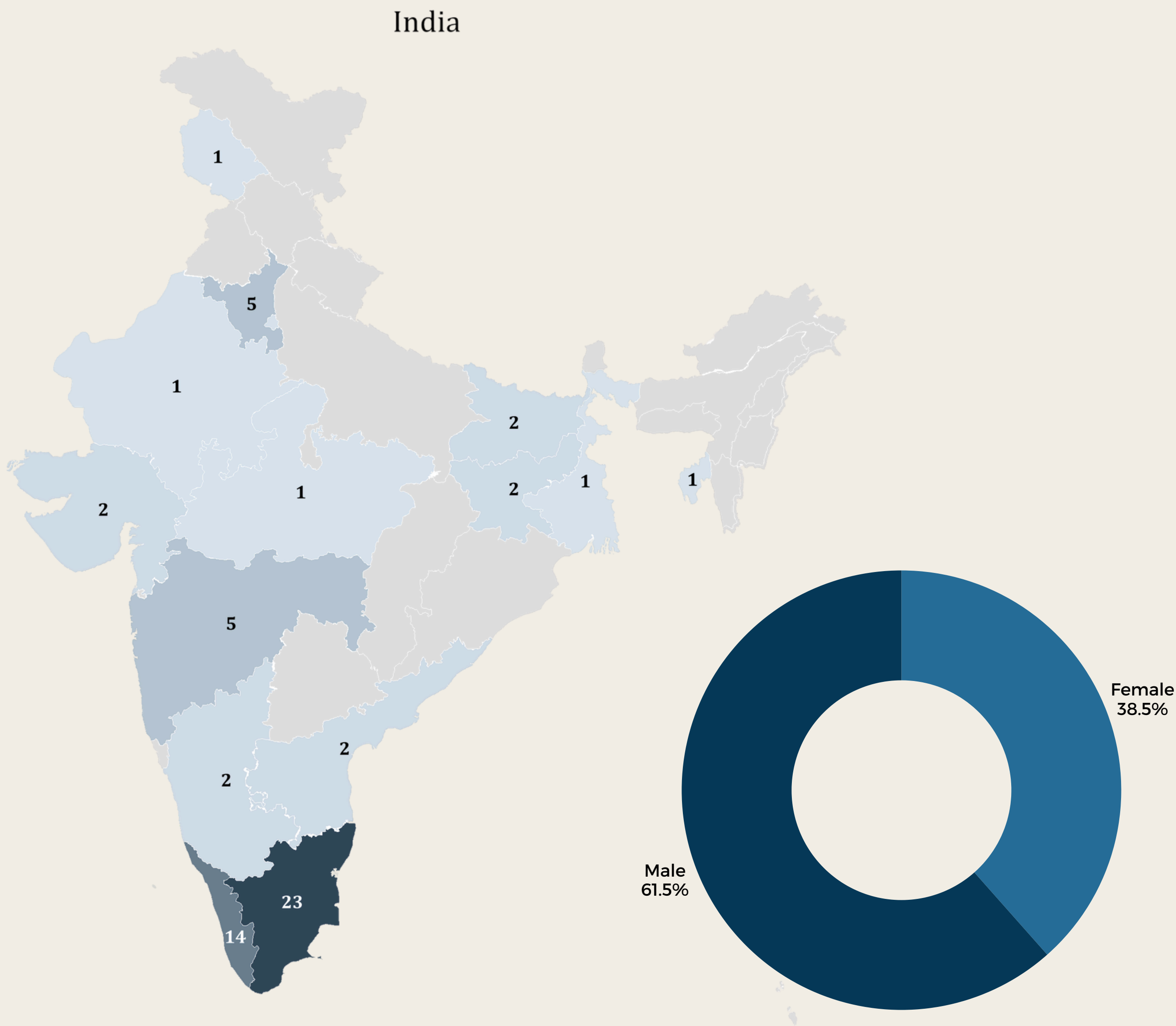
4. Ready-to-Eat (RTE) Retort Products: He explained the basic principles of canning, including hermetic sealing, air removal, and thermal processing at 121.1°C to achieve commercial sterility. Various packaging formats such as tin cans, aluminum cans, glass jars, retort pouches (three- or four-layer laminates), and tetra packs were explained.

He emphasized that labels must include brand name, product description, net weight, manufacturing and expiry dates, batch number, FSSAI license number, allergen information, and price details. Licensing requirements such as FSSAI registration, MSME registration, trade license, export license, and statutory compliances (EPF, ESI where applicable) were discussed.

He highlighted that successful seafood entrepreneurship requires balancing consumer acceptability with consumer safety. Finally, the session concluded with production costs, and marketing channels including retail outlets, supermarkets, export markets, B2B and B2C models, and online platforms.



Participants Overview



Total Registration - 65
 (Male - 40; Female-25)
 Attended Participants - 59

YouTube Video Link: <https://www.youtube.com/watch?v=4AKuYM3EEDw&t=5s>

7



Ornamental Fish Culture

Ornamental Fish Culture



Dr. Binu Varghese
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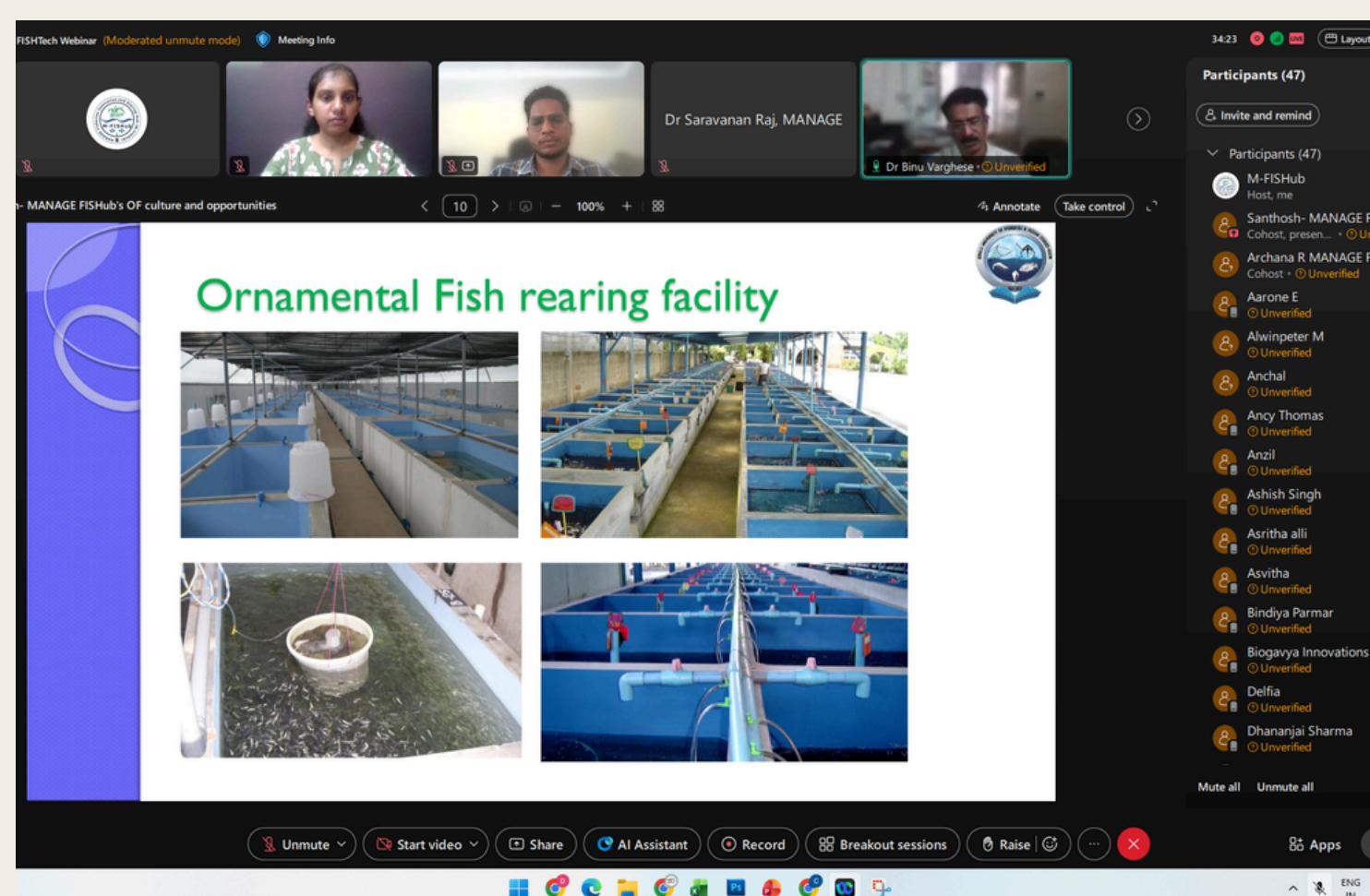
Dr. Binu Varghese delivered a comprehensive and practically oriented presentation on the scope and entrepreneurial potential of ornamental fisheries, highlighting its growing domestic and global market significance

Dr. Varghese highlighted that the ornamental fish sector is no longer just a hobby but a booming global industry valued between \$10 billion and \$20 billion. He stressed that, a unique feature of this sector is its scalability; an individual can start a venture with as little as a pair of guppies in their backyard or invest crores in a high-tech facility. He emphasized that the sector is particularly suited for:

- **Rural Entrepreneurs and Women:** Providing a source of income through backyard breeding units.
- **Tech-driven Startups:** Opportunities exist in manufacturing indigenous accessories to reduce dependence on Chinese imports.
- **Service Sector:** There is a high demand for professional aquarium maintenance and "service sector" expertise in urban hubs like Bangalore.

To compete internationally, there is a need for improved biosecurity and standardized production systems. While India has rich biodiversity hotspots like the Western Ghats and the Himalayas, the industry has struggled with maintaining consistent quality and quantity for export. He noted that while 90% of global trade comes from cultured fish, India still relies heavily on wild-caught species for export, which is increasingly regulated by wildlife schedules.

Dr. Varghese explained that successful ornamental fish farming requires quality broodstock, consistent production of multiple varieties, proper tank design, separate water systems to prevent disease transmission, and adherence to international size and quality standards.



He noted that one of India's major constraints in export growth is the inability to supply uniform quality and consistent volumes weekly. Therefore, cluster-based production models and Farmer Producer Organizations (FPOs) were suggested as practical solutions to aggregate production and streamline marketing.

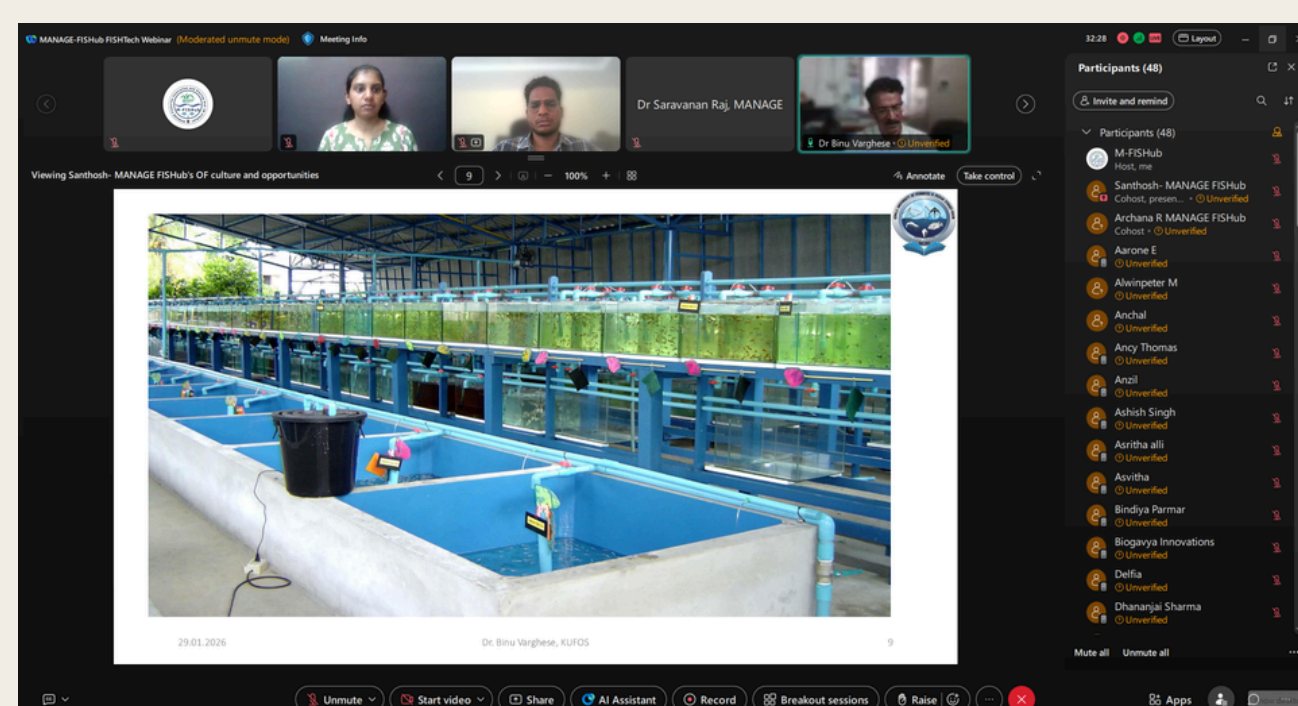
Dr. Varghese further discussed emerging opportunities in premium segments such as marine ornamental fish, reef aquariums, high-value species like **Arowana**, **Japanese Koi**, and rare indigenous species such as Channa species.

He also noted constraints for new beginners which includes

- **Market Linkages:** A disconnect between production hubs (West Bengal, Tamil Nadu) and growing consumer markets in North India.
- **Price Disparity:** Significant gaps between wholesale and retail prices often discourage small farmers.
- **Variety Development:** India has lagged in developing new strains. For example, the indigenous Denisoni was taken abroad, where foreign breeders developed "Golden" and "Lipstick" varieties, effectively capturing the market for Indian resources.

He emphasized about the conservation implications of overexploitation and stressed the importance of developing breeding protocols for indigenous high-value species rather than depending on wild collection. Also stressed that genetic improvement and strain development are important and explained how countries like China have developed numerous goldfish and koi varieties through systematic selective breeding over decades.

Ornamental fisheries hold immense potential for self-employment, women empowerment, youth entrepreneurship, and rural livelihood diversification. With proper training, market linkage, cluster-based production, and policy support, India can significantly enhance its domestic market share and global export presence.





Q & A Session

1 In India, which certified agencies issue health certificates, disease free certificate for exporting live ornamental fish?

In India, health certificates and disease-free certificates for exporting live ornamental fish are mainly issued by authorized government agencies. The primary authority is the Export Inspection Council of India (EIC) and its regional Export Inspection Agencies (EIAs), which certify export consignments as per importing country requirements.

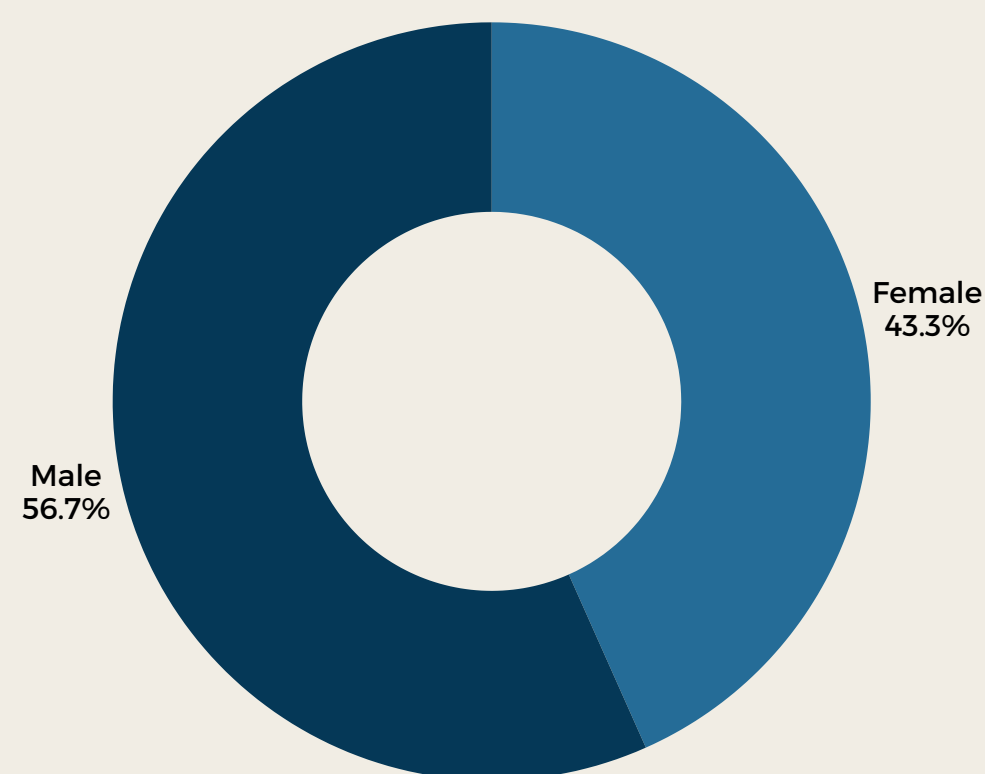
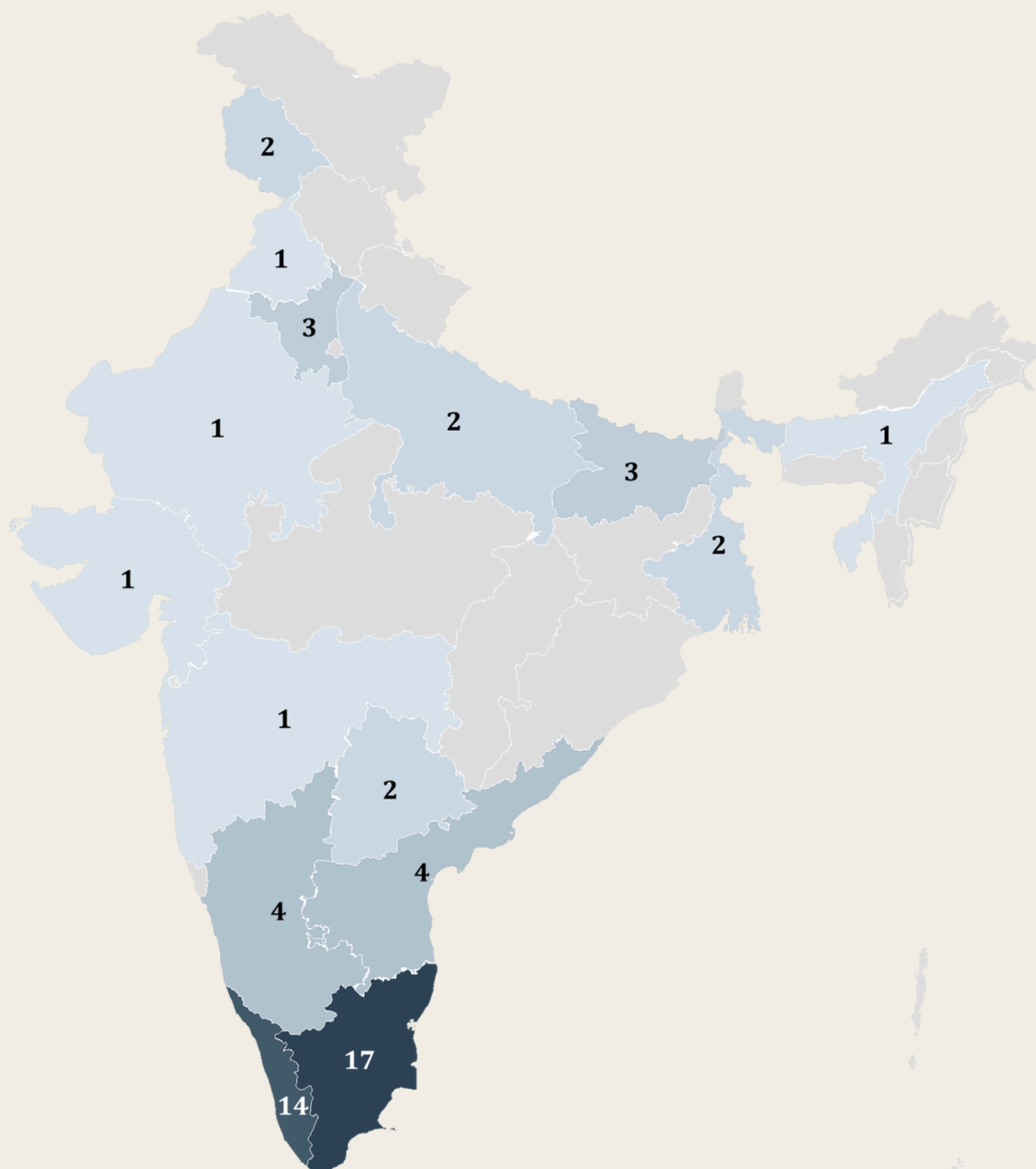
The Marine Products Export Development Authority (MPEDA) also plays a supporting role in regulating and promoting seafood exports, including ornamental fish.

2 What are the schemes under PMMSY that promote ornamental fish culture?

Under Pradhan Mantri Matsya Sampada Yojana (PMMSY), several components support the promotion of ornamental fish culture in India. The scheme provides financial assistance for setting up freshwater and marine ornamental fish breeding units, hatcheries, rearing units, and backyard ornamental fish units. It also supports the establishment of integrated ornamental fish hubs, brood banks, and infrastructure such as aquariums, quarantine facilities, and live fish transport systems.

Participants Overview

India



Total Registration - 60
(Male - 34; Female-26)
Attended Participants - 55

YouTube Video Link: <https://www.youtube.com/watch?v=9IjBSIPbm1A&list=PL4>

8



Mud Crab
Culture

New Trends in Mud Crab Culture and Management



Dr. Naveen Nivas
Guest Faculty
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Dr. Naveen Nivas, delivered a comprehensive and technically sound presentation on Recirculating Aquaculture Systems (RAS) and their role in sustainable and intensive aquaculture development. Also focused on transitioning India's mud crab sector from wild-dependent fattening to a standardized, technology-driven industry.

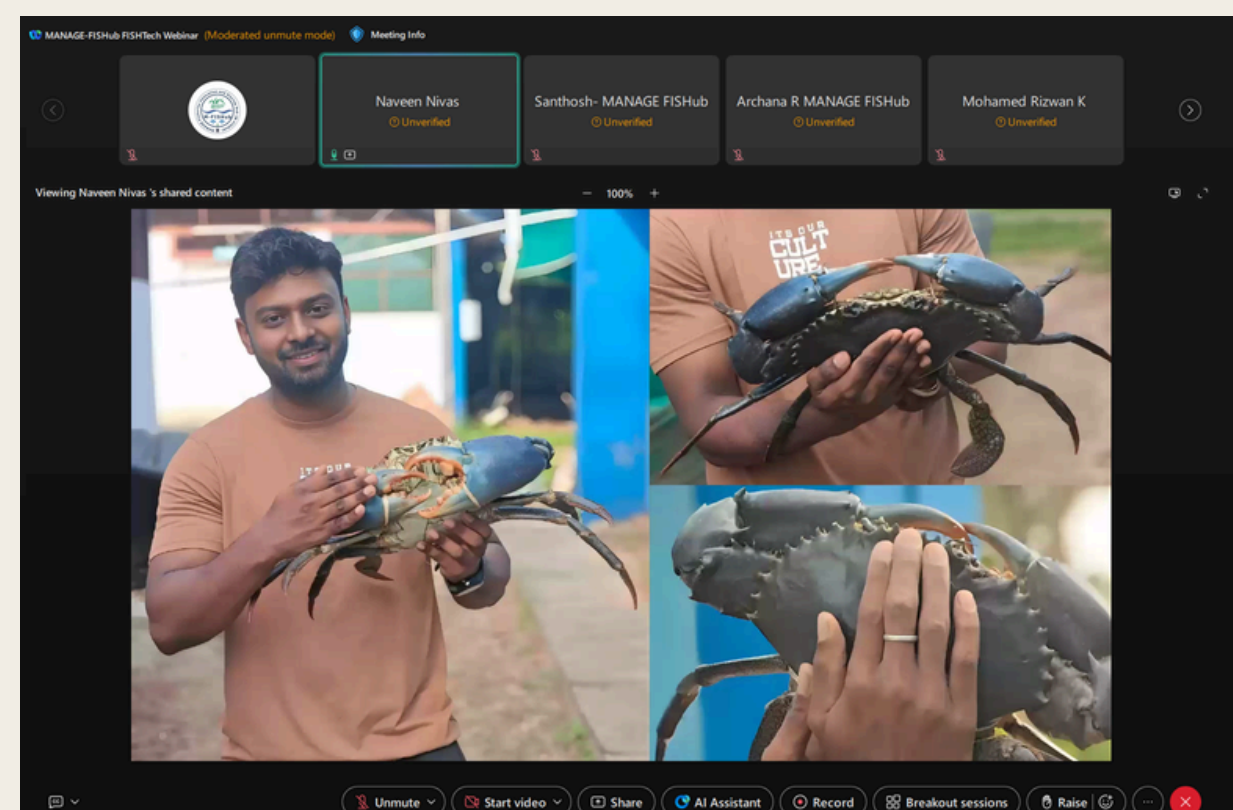
Dr. Naveen highlighted the dramatic market value of ***Scylla serrata* (Mud Crab)**, positioned as a high-value, low-volume indigenous species compared to the fragile, export-dependent ***Litopenaeus vannamei*** (shrimp) industry. While shrimp prices fluctuate around 400–500/kg, mud crabs can fetch 1,000–1,200/kg for smaller sizes. Currently, the Asia-Pacific region contributes 76% of the global crab market, but emerging demand in Europe and the U.S. offers significant growth opportunities. Despite this, India lags behind competitors like Vietnam and Bangladesh due to a critical shortage of hatcheries. India currently has only one active facility (RGCA), whereas Vietnam operates over 500.

He emphasized that RAS technology offers a viable solution by enabling high-density fish production within a controlled indoor environment while minimizing water use and environmental impact and also explained that Recirculating Aquaculture Systems function by continuously filtering and reusing water through mechanical, biological, and chemical treatment units.

He detailed the major component of Recirculating Aquaculture System (RAS), including

- Culture tanks,
- Mechanical filter for solid waste removal
- Biofilters for ammonia conversion through nitrification
- Aeration or oxygenation systems
- UV or ozone disinfection units
- Pumps
- Monitoring sensors

He stressed that maintaining optimal water quality parameters such as dissolved oxygen, temperature, pH, ammonia, nitrite, and nitrate levels—is critical for the success of RAS operations.



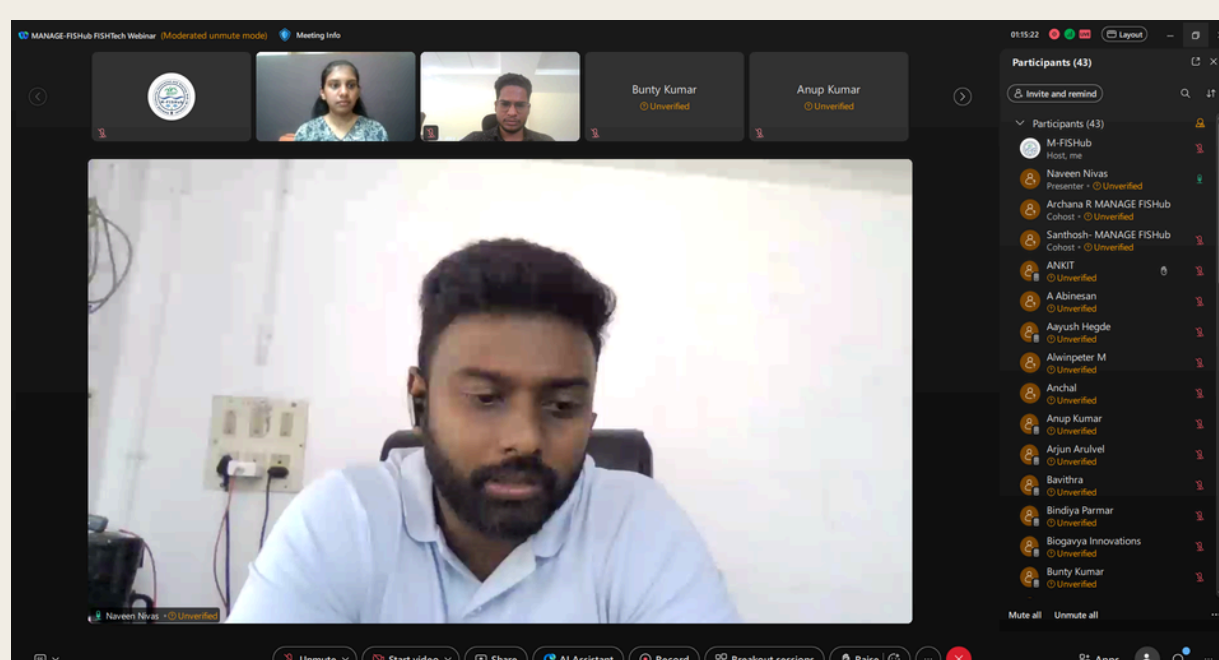
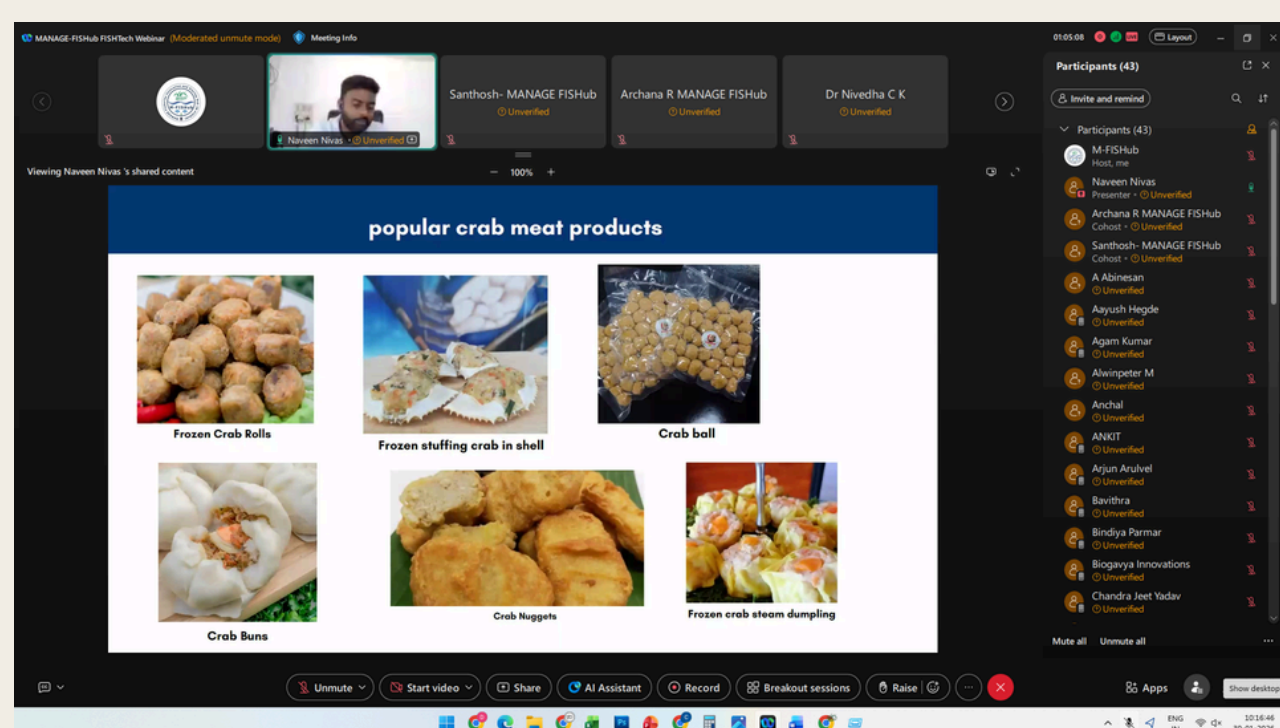
He discussed different RAS designs, including small-scale modular units for startups and large-scale commercial systems. The most significant technological shift is moving from open-water ponds to controlled indoor systems.

- **Habitat-Enhanced RAS (HE-RAS):** This system mimics the crab's natural turbid (muddy) environment rather than using clear water. This reduces stress, improves post-transport recovery, and has achieved a record 95% survival rate.
- **Vertical Crab Farming (Crab Apartments):** To combat cannibalism, crabs are housed in individual HDPE boxes or "apartments" stacked vertically. This maximizes space and allows for individual monitoring of molting and feeding.
- **Indoor Vertical Circulatory Units:** Where saline water (15–22 ppt) is purified through sand filters and recirculated, making farming possible even in landlocked areas.

Also, he emphasized some of the profitable avenues for crab farming:

- **Soft-Shell Crab Farming:** A highly sustainable model with massive demand in Japanese and European restaurants. These are frozen immediately after molting and can be sold for approximately \$30 USD even for small sizes.
- **Hard-Shell and Jumbo Crabs:** Categorized by weight from Small (200g) to Jumbo (1.2kg+), with farm-gate prices for larger categories reaching Rs 4,500.
- **Roe (Egg) Fattening:** Targeting mature females to produce premium products where the egg content is maximized over a 10–30 day holding period.
- **Processed Goods:** Emerging markets for crab lollipops, crab meat, pickles, and high-end crab protein for European fine dining.

Overall, the session provided valuable insights into entrepreneurial opportunities in intensive mud crab culture.





Q & A Session

1 Which king-size crab that is popular in Australia is suitable for culture in India?

The king-size crab popular in Australia is the Tasmanian giant crab, also called the giant deep-water crab. However, this species is not suitable for culture in India because it lives in cold, deep waters and requires a temperate climate, which is very different from India's tropical coastal conditions. For India, the most suitable and commercially important large crab species is the Giant mud crab (*Scylla serrata*).

2 What is a good marketing strategy for crab cultivation, considering that buyers prefer wild crab?

A good marketing strategy for crab cultivation is to focus on quality, consistent size, and live delivery. Promote cultured crabs as clean, safe, and available throughout the year, unlike seasonal wild crabs. Build strong relationships with hotels, exporters, and seafood shops, and ensure proper grading and attractive packaging. Supplying healthy, live crabs regularly will help gain buyer trust and increase demand.

3 Which is better for mud crab fattening: PVC pipe or trap box?

For mud crab fattening, trap boxes are generally better than PVC pipes for commercial purposes. Trap boxes allow individual stocking, reduce cannibalism, make feeding easy, and help in monitoring growth and shell hardness. They also give better survival rates and uniform size, which is important for market demand. PVC pipes are cheaper and suitable for small-scale or pond-based systems, but they make monitoring and harvesting more difficult. So, for higher survival, better management, and commercial production, trap boxes are the better option.

4 Is the nutritional requirement for crab fattening to achieve big-size or king-size crabs the same as that of wild crabs?

Wild crabs get a natural and varied diet such as small fish, molluscs, and organic matter from their habitat. Their nutrition depends on what is available in nature.

In crab fattening systems, farmers must provide a balanced and high-protein diet to promote faster growth, better meat filling, and strong shell development. Usually, trash fish, mussel meat, clam meat, or formulated feeds with adequate protein (around 35–45%) are given. Proper feeding management is important to achieve big or king-size crabs in a short period.

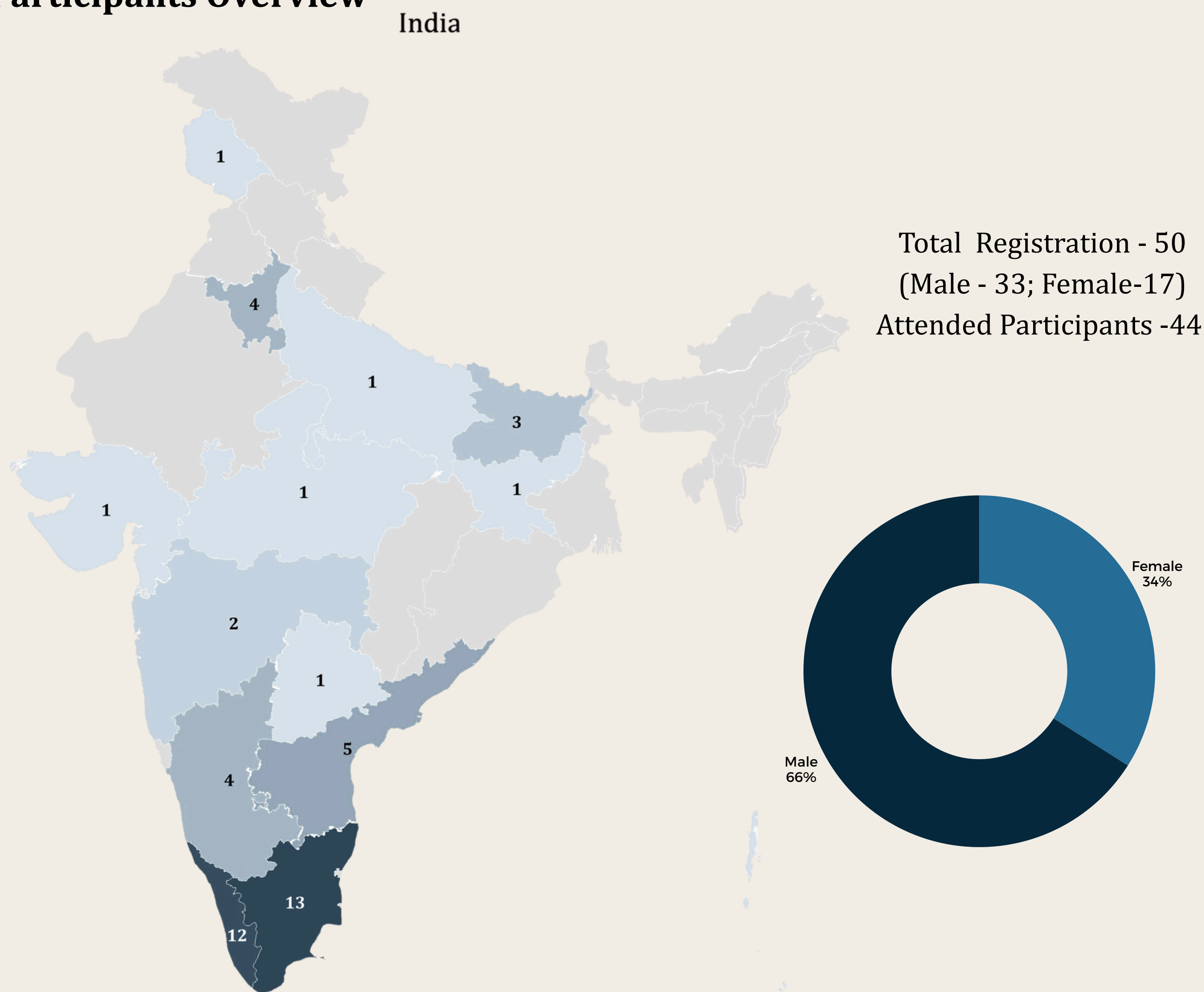
5 What are the schemes and best options for self employment in crab cultivation?

In India, self-employment in crab cultivation is supported through schemes like Pradhan Mantri Matsya Sampada Yojana (PMMSY), which provides financial assistance for mud crab farming, fattening units, hatcheries, nurseries, and integrated aquaculture systems. Additional financial and technical support is available through the National Fisheries Development Board (NFDB) and State Fisheries Departments.

6 Cultured crabs survive only one or two days, whereas wild crabs can survive for more than four days. Can you suggest ideas to enhance marketability?

To enhance the marketability of cultured crabs, improve their survival through proper post-harvest handling, such as correct claw tying, maintaining cool and moist conditions, and using insulated boxes during transport. Avoid overcrowding and reduce stress to increase survival time.

Participants Overview



YouTube Video Link: https://www.youtube.com/watch?v=m_cQ6duSUvI&t=1398s



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