English Monthly from Hyderabad, India

Aqua International

Health • Nutrition • Technology • Management

February 2025

Annual Subscription: ₹800 Foreign USD 100

Inside...

Aqua International

English Monthly Magazine
(Established in May 1993)

Volume 32 Number 10 February 2025

Editor & Publisher
M. A. Nazeer

Editorial & Business Office:
AQUA INTERNATIONAL
NRS Publications,
BG-4, Venkataramana Apartments,
11-4-634, A.C.Guards,
Hyderabad - 500 004, India.
Tel: 040 - 2330 3989, 96666 89554
E-mail: info@aquainternational.in
Website: www.aquainternational.com

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

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

Edited, printed, published and owned by M. A. Nazeer and published from BG-4, Venkataramana Apts., 11-4-634, A.C.Guards, Hyderabad - 500 004, India. Printed at Srinivasa Lithographics.
Registered with Registrar of Newspapers for India with Regn. No. 52899/93. Postal Regn. No. L II/ RNP/HD/1068/2021-2023.

NRS PUBLICATIONS
www.aquainternational.in

CONTENTS

ADVERTISERS' INDEX

Subscriptions for Aqua International, English monthly, should be sent to:
The Circulation Department, Aqua International, BG-4, Venkataramana Apartments, 11-4-634, A.C.Guards, Near Income Tax Towers, Hyderabad - 500 004, India. Email: info@aquainternational.in

FAMSUN

Integrated Solution Provider

Vacuum coater

Exceptional design & Flexible operation

Vacuum coater for the application of oil or fat, pigments, flavors, functional improver, vitamins, etc. onto pellets after drying and/or cooling. Aquafeed and pet food in particular.

FAMSUN Co., Ltd.

Add: No.1 Huasheng Road, Yangzhou, Jiangsu, China 225127
T:+86-514-87848880
E-mail:mypublic@famsungroup.com
www.famsungroup.com

India Office

Add: No 401 , Dega Towers , Raj Bhavan Road , Somajiguda , Hyderebad , Telangana - 500082
T: +62-21-30027458; 30027459
Contact: Arun Kumar K
E-mail : arunkumar@famsungroup.com
Mob: +91 9901916554

Contact: Shelby
E-mail: lxb@famsungroup.com
Mob: +91 9100436652

Make farmers knowledgeable to do culture well

Molecular markers will play a major role in bringing out quality and sustainability to aquaculture. Molecular markers have wide range of applications in aquaculture mainly in genetic identification and discrimination of hatchery stocks, finding out inbreeding events, assignment of progeny to parents using genetic tags.

Dear Readers,

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

Mr B. Roy Chowdhury, Minister of State (Independent Charge), Department of Fisheries, Government of West Bengal advised the industry stakeholders to assess and analyze what could be done for betterment of aquaculture in West Bengal. Improved methodologies have to be made known to farmers to increase fish and shellfish production. We have to analyze what kind of opportunities small-scale fish farmers in remote villages in West Bengal are getting to increase farmed fish production to get ahead in fish culture.

Unfortunately, with an aim to increase shrimp production, shrimp farmers used ethoxyquin and suffered huge loss in shrimp farming few years back due to its impact. Farmers should be aware of such incidences. Minister urged business persons to produce and sell more good products which may be affordable to farmers and contribute to increase in amount of farmed fish and shellfish production, more protein-rich foodfishes.

CLFMA of India hosted a collaborative meeting organized by BCC & US Grains Council at Coimbatore on January 14 with primary focus of the event to discuss the current grain supply and demand dynamics in both India and the USA. The US Grains Council (USGC) team presented insightful updates on recent advancements in crop production and emerging technologies used in agriculture, showcasing their potential benefits for the animal feed sector. CLFMA President emphasized the need to spotlight aquaculture, poultry and dairy sectors for their pivotal roles in fostering growth and innovation. Dr Harsha Kumar Shetty updated on the statistics of grains in India and its forecast. He also highlighted the need for alternative feed ingredients and that further study needs to be conducted on alternatives like Sorghum. He emphasized the importance of conducting field trials to assess its viability and its economic impact. Price parity of various US grains, their derivatives and closing grain inventories were key areas of deliberation during the meeting.

The young entrepreneur and Director of Deepak Nexgen Feeds Mr A. Chaitanya Vasu says that Soil, Water, Climate and Quality of Seed should be good if feed has to show its performance & results for better shrimp yield. It is important to use natural binders in feed formulation. We do not use chemical binders and synthetic binders. Chemical and synthetic binders will damage the bottom of pond and will also affect FCR. FCR plays key role in the quality of feed. Good FCR depends on soil and density of shrimp seed stocked in the pond. Putting one lakh seed per acre will get good FCR, of course climate will also matter. . Exchange of water is also very important. At moult time, if fresh water is added it will help to moult easily.

Farmers are facing difficulties mainly due to climatic conditions in shrimp culture. We see what the farmers are expecting from feed companies with regard to shape, size, colour, smell, sinking and stability of the feed. Vasu feels that summer is good for digestibility of the feed than winter and rainy season. First of all, financial discipline in any segment of the industry is important, besides good raw

Contd on next page

NRS GROUP
Aqua International

Our Mission

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

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

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

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

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

TALK TO US

SEND AN EMAIL:
info@aquainternational.in
Please do not send attachment.

FOLLOW US:
facebook.com/aquainternational.nrs
twitter.com/nrspublications

Send a letter: *Letters to the Editor must include writer's full name, address and personal telephone and mobile numbers. Letters may be edited for the purposes of clarity and space. Letters should be addressed to the Editor:*

AQUA INTERNATIONAL, BG-4, Venkataramana Apartments, 11-4-634, A.C.Guards, Near Income Tax Towers, Masab Tank, Hyderabad - 500 004, T.S, India.
Tel: +91 040 - 2330 3989, 96666 89554. Website: www.aquainternational.in

material purchase and quality feed production.

AquaExchange established in 2020 by four engineering professionals is providing technology for shrimp and fish culture which the company claims to be beneficial to farmers. The promoters of Aqua Exchange say that a farmer who uses Whatsapp in mobile phone can easily adopt Aqua Exchange technology for monitoring shrimp ponds. According to them, the company will also arrange crop loan to shrimp farmers of Rs 2.5 lakhs per acre through banks and also arrange crop insurance against diseases. Now the technology is adopted by 50,000 acres of shrimp farms in Andhra Pradesh, Odisha, Tamil Nadu andto them, the company will also arrange crop loan to shrimp farmers of Rs 2.5 lakhs per acre through banks and also arrange crop insurance against diseases. Now the technology is adopted by 50,000 acres of shrimp farms in Andhra Pradesh, Odisha, Tamil Nadu and Gujarat states, but 95% of it is in Andhra Pradesh. They say that 4,800 farmers are using Aqua Exchange technology and arranged loans upto 4,500 acres to 150 farmers in Andhra Pradesh alone.

In the Articles section, article titled **Why Thai mangur debarred in Bihar?**, authored by Anjali kumara, discussed that Molecular markers will play a major role in bringing out quality and sustainability to aquaculture. Molecular markers have wide range of applications in aquaculture mainly in genetic identification and discrimination of hatchery stocks, finding out inbreeding events, assignment of progeny to parents using genetic tags. To finding out quantitative trait loci, marker assisted selection for selective breeding trials and assessment of the effect of polyploidy induction and gynogenesis.

Magur is the correct spelling of the name of the freshwater fish that is also known as the Asian catfish. It is also sometimes called Mangur. The Magur fish is a freshwater catfish that lives in the Ganges and Brahmaputra rivers in India. It is a popular food fish in India and Bangladesh, and is known for its taste and nutritional value. Magur fish can survive out of water for a considerable time and can move short distances. It is a hardy fish that can be found in ponds, rivers, and mud. Magur fish is a whole fish that is a popular dish in Bengali cuisine.

Another article titled, **Impact of Microplastics on Aquatic Organisms, Ecosystems and Human Health**, authored by N. Karthik, Anzil Rikesh and S. Felix said that Over the past seventy years, there has been a significant increase in plastic production, rising from 1.5 million tons in the 1950s to 367 million tons in 2020. This surge in plastic production is closely linked to the growth of the human population, which has more than doubled from about 3.1 billion in 1961 to around 7.3 billion in 2015, projected to exceed 9 billion by 2050. The escalating demands of this population growth are expected to drive the plastics commodity market, alongside the increasing demand for fishery and aquaculture products. Estimates based on current growth rates suggest that plastic production is set to double by 2025 and more than triple by 2050. The mass production and consumption of plastics have led to the accumulation of these materials in natural habitats, resulting in adverse impacts on both biota and the economy. Approximately 275 million tons of plastic wastes were generated globally in 2010, with between 4.8 million and 12.7 million tons of this waste entering the oceans due to improper management by coastal countries. Once in the environment, plastic objects degrade into smaller fragments, entering the food chain directly or indirectly contaminating it through the leaching of potentially harmful chemicals.

Another article titled, **Challenges and Solutions in Meghalayan Aquaculture: Advancing hill Aquaculture through Technological Innovation and Social Inclusion**, authored by Chandan Debnath, Bankitkupar Mukhim and S. Gojendro Singh discussed that the aquaculture sector in Meghalaya faces a substantial production deficit with current output at 18,000 MT significantly below the regional requirement of 36,360 MT. This gap holds particular significance as over 22,000 individuals depend on fisheries for their livelihood.The state's distinctive matrilineal social structure presents a unique opportunity for sector development, as historical evidence suggests that women's participation in agricultural enterprises often correlates with higher success rates and improved productivity outcomes. The integration of traditional knowledge with modern aquaculture practices creates a foundation for sustainable development in the region.

Another article titled, **Improving Finfish Aquaculture: Recent Advances in Genetics and Breeding**, authored by J. Magimai John Jose, S.Selvaraj, A. Jackqulin Wino and R. Jeya Shakhila, discussed that advancements in finfish genetics and breeding are revolutionizing aquaculture into a sustainable and resilient sector. Latest methodologies include selective breeding, hybridization, molecular techniques and genome editing. Selective Breeding: Significant improvements in species like Atlantic salmon, tilapia and carp with annual growth gains of up to 20%. Hybridization: Utilizes heterosis to produce robust and high-performing hybrids. Genome Editing:Tools like CRISPR-Cas9 and TALENs enable precise modifications for traits such as growth and disease resistance. Molecular Breeding Techniques: Marker-Assisted Selection (MAS) and Quantitative Trait Loci (QTL) mapping accelerate sustainable aquaculture practices. Reproductive Biotechnologies: Innovations like cryopreservation, monosex population production and germ cell transplantation improve broodstock management and resource conservation.

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

M.A. Nazeer
Editor & Publisher
Aqua International

Uni-President

AQUACULTURE PROBIOTICS EXPERT

Nu Ri
NET 200 g **BSL**

Probiotics for water treatment

1. WATER QUALITY CONDITIONING

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

2. HIGH ACTIVITY OF SPORES

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

3. DECREASE AMMONIA CONTENT

Prevent the accumulation of toxic substances such as NH_3, NO_2, etc.

4. IMPROVE WATER COLOR

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

5. ESTABLISH BALANCED POND BACTERIA SYSTEM

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:

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

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

UNI-PRESIDENT VIETNAM CO., LTD

No. 16-18-20, DT 743 Road, Song Than II Ind Zone, Di An Ward, Di An City, Binh Duong Province, Vietnam.

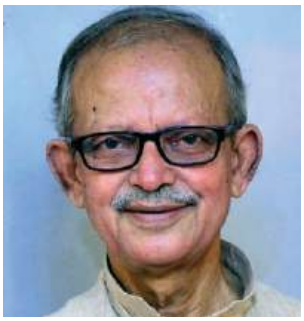
aquafeed@upvn.com.vn
www.uni-president.com.vn

Fisheries Minister advises the industry to educate farmers to know improved methodologies and to increase fish and shellfish production in West Bengal

Contai: In the next one year period, we have to assess and analyze what could be done for betterment of aquaculture in West Bengal. Improved methodologies have to be made known to farmers to increase fish and shellfish production. We have to analyze what kind of opportunities small-scale fish farmers in remote villages in West Bengal are getting to increase farmed fish production, to get ahead in fish culture, said Mr B. Roy Chowdhury, Minister of State (Independent Charge), Department of Fisheries, Government of West Bengal.

Unfortunately, with an aim to increase shrimp production, shrimp farmers used ethoxyquin and suffered huge loss in shrimp farming few years back due to its impact. Farmers should be aware of such incidences. No company should exhibit and sell products prohibited for aquaculture, or that may be harmful in the long run, the minister stated addressing Bengal Aquaculture Expo 2025 organized at Contai Aqua Technicians Welfare Association, Purba Medinipur, West Bengal organized the event.

Mr Roy Chowdhury welcomed aquaculture products producing companies, participating fish and shrimp farmers, entrepreneurs and others who want to know more about modern aquaculture practices.



Fisheries Minister of West Bengal B. Roy Chowdhury

Mr Roy Chowdhury urged business persons to produce and sell more good products which may be affordable for farmers and contribute to increase in amount of farmed fish and shellfish production, more protein-rich foodfishes. It will lead to success of organizing this grand Aquaculture Expo.

Careless and conventional unscientific aquaculture practices without any control on stocking density of fish and shellfish seeds and other aspects must be strictly avoided.

West Bengal Fisheries Department is organizing more and more training programmes for fish farmers for the last two years. Supplementary feed should be given to fishes in pond. Plankton production should be increased and be routinewise estimated, along with essential pond water and soil parameters. Rural youth do not know these processes, will be able to know more from trainings. Facilities for pond soil and water testing for fish farmers have been initiated in all Community Development Blocks in each and every district of the state.

In near future, we will be able to develop good fish farmers. Rural youth may go for scientific fish and shellfish culture after obtaining training, will get highly satisfactory income every month from at least two well-maintained culture ponds. They should know and understand how to do fish farming following proper and good methods - then they will give more attention to it, will be self-reliant, which will generate self-employment. They must know how to prepare supplementary formulated feed for growing fishes, ideal quality of pond water, which kind of fish and shellfish species grow in which kind of water, required depth of pond water and soil quality. The more they do pond soil and water testing and more they know the methods, more they will be 'self-helped' and more will be the production. Such persons will gain self-confidence, grow, hold prestige in society and stand with head held high. Science-based aquaculture practices should be introduced in greater extent.

Mr Roy Chowdhury opined that collaborative effort between the private aquaculture product producing companies and Department of Fisheries is needed – which will help us to move ahead, success will come in terms of betterment of the fish farmers and fish production. We will progress further.

Main stage of Bengal Aquaculture Expo 2025

Moyna Model accepted as an example for grow-out freshwater major carp culture in West Bengal

Moyna CD Block in Purba Medinipur district, West Bengal was declared as fishery hub in West Bengal by the State Government; the 'Moyna Model' accepted as an example for grow-out freshwater major carp culture throughout the state. Moyna is an example of freshwater fish culture revolution in West Bengal and a new horizon for culture of major carps. Adult Indian major carps are produced and supplied in live condition from Moyna to Kolkata and different districts in West Bengal, also to neighbouring states. According to Scientists of ICAR-CIFA Regional Research Centre, Rahara, Kolkata, Moyna has a rapidly growing aquaculture industry that employs a diversity of production systems and unique indigenous transport techniques. Government of West Bengal proclaimed Moyna as an 'aquaculture hub', giving it a prominent place on aquaculture map of this state.

The Moyna Aqua Expo 2025 was organized by Moyna Matsya Unnayan Committee, in collaboration with Moyna Fish Farmers Welfare Association and Moyna Fish Feed Traders Welfare Society on January 24 - 25 at Dakshin Anukha village. Technical session was also organized on the occasion.

Mr B. Roy Chowdhury, Minister of State (Independent Charge), Department of Fisheries, Government of West Bengal was present and had extended discussion with progressive fish farmers of Moyna Block about means of further development and maintenance of good reputation of fish farming practices at Moyna.

In the scientific sessions on both days, Dr P. P. Chakraborti, Principal Scientist, ICAR-CIFA Regional Centre, Kolkata; Dr A. K. Das, Principal Scientist, ICAR-CIFRI, Barrackpore; Dr K. L. Das, Asst. Director of Fisheries, Bankura district; State Government officers Dr N. Bag, Mr T. Das, Dr R. Kundu, Mr S. K. Sahu and Mr S. Ghosh spoke about newer aspects of freshwater fish culture addressing the participants for betterment of fish culture, fish production and farmers income. Zoologists and fishery experts-cum-advisors Dr P. P. Biswas, Dr B. Bandyopadhyay and others were also present in the Expo.

News communicator Subrato Ghosh was present in the program.

Soil, Water, Climate and Quality of Seed should be good if feed has to show its performance for better Shrimp yield: A. Chaitanya Vasu

The young Director of Deepak Nexgen Feeds Pvt Ltd A. Chaitanya Vasu talked to Aqua International editor about his 8 years experiences in Aquaculture. The young director after his MS in UK started his career with learning in shrimp farming and then in the production activities of feed plant.

Vijayawada: Deepak Nexgen Feeds Pvt Ltd is working to further strengthen its shrimp and fish feed quality, so that the farmer will be benefitted with better yield and output from the ponds, said Mr A. Chaitanya Vasu, Director, Deepak Nexgen Feeds.

After doing his BBA and MS – International Business Management from Leeds University, United Kingdom, Mr Chaitanya Vasu came to India in 2010. From 2010 to 2015, he worked in shrimp and fish culture. In 2016, he looked after the new **ifeed** feed plant construction and in 2017, the company came into the production of ifeed. Again in 2018 Chaitanya Vasu started shrimp culture in 300 acres.

Farmers are facing difficulties mainly due to climatic conditions in shrimp culture. We see what the farmers are expecting from feed companies with regard to shape, size, colour, smell, sinking and stability of the feed. Mr Chaitanya Vasu is presently taking care of production of fish and shrimp feeds in Deepak Nexgen. Total feed plant management, raw material testing, quality check, quality control and dispatch of the feed in the factory, HR and Employees welfare

A. Chaitanya Vasu, *Director,Deepak Nexgen Feeds Pvt Ltd*

is taken care by Mr Chaitanya Vasu. He has eight years of experience in the feed plant for the production and quality control.

It is important to use natural binders in feed formulation. We do not use chemical binders and synthetic binders. Chemical and synthetic binders will damage the bottom of pond and will also affect FCR, said Chaitanya Vasu adding that FCR plays key role in the quality of feed. Good FCR depends on soil and density of shrimp seed stocked in the pond. Putting one lakh seed per acre will get good FCR, of course climate will also matter.

Exchange of water is also very important, he stated. At moult time, if fresh water is added it will help to moult easily.

Soil, water, climate and quality of seed should be good if feed has to show its performance and results to get better shrimp yield, Vasu said.

Vasu feels that summer is good for digestibility of the feed than winter and rainy season.

Replying to a question, Mr Chaitanya Vasu said, first of all financial discipline in any segment of the industry is important, besides good raw material purchase and quality feed production.

Working in shrimp culture at ponds and in production of feed at the factory helped me to understand what kind of feed needed to the farmers and what the farmers are expecting from us as feed miller. I could know it well and today I have the confidence that Deepak Nexgen is producing good quality feed for fish and shrimp culture, stated Mr Chaitanya Vasu. We have our own 100 vehicles alone for delivery of feed at ponds within Andhra Pradesh state, and contract vehicles to other states for feed delivery, he added.

Answering to a question, Vasu said, Aquaculture industry will flourish if government subsidy is available to the farmers on time. If farmers get good price for shrimp and fish, we all will have good prospects and the industry can grow.

As a group, we at Deepak Nexgen are successful not only in feed, but also in all our activities, stated the young director of the company. In 2025, the young entrepreneur Chaitanya Vasu sees international trade to be better and the Indian shrimp would get better price.

CLFMA hosts collaborative meeting organized by BCC & US Grains Council

Mumbai: On 14 January 2025 CLFMA of India and BCC co-hosted a significant joint event organized by the Broiler Coordination Committee (BCC) and the US Grains Council (USGC) at Coimbatore. The meeting brought together top officials from the US Grains Council (USGC), Verity Ulibarri, Chairwoman, U.S. Grains Council, Amy France, Board Chair, National Sorghum Producers, Mark Wilson, Vice Chairman, U.S. Grains Council, Ethan Miller, Vice Chairman, United Sorghum Checkoff Program, Jay Reiners, Secretary-Treasurer, U.S. Grains Council, David Schemm, President, Arrow S Farms, Brent Boydston, Past Chairman of the Board, U.S. Grains Council, Clint White, Director of Communications, United Sorghum Checkoff Program, Tim Lust, CEO, United Sorghum Checkoff Program, Ryan LeGrand, President and CEO, U.S. Grains Council, who traveled from the USA & Reece Cannady, Regional Director – South Asia, U.S. Grains Council, Amit Sachdev, Regional Consultant, U.S. Grains Council, Nayantara Anandani Pande, Marketing Specialist, U.S. Grains Council, Sonjoy Mohanty, Senior Ethanol Advisor, U.S. Grains Council from New Delhi along with

Divya Kumar Gulati,
Chairman,CLFMA of India

key representatives from Tamil Nadu's poultry sector, including members of the BCC, also Mr M.R.I. Magdum, Dr Harshakumar Shetty and Dr Nagabhushan from Venkateshwara Hatcheries Pvt Ltd, and members from PFRC graced the occasion, making it a noteworthy gathering of industry leaders.

The primary focus of the event was to discuss the current grain supply and demand dynamics in both India and the USA. The US Grains Council (USGC) team presented insightful updates on recent advancements in crop production and emerging technologies used in agriculture, showcasing their potential benefits for the animal feed sector.

CLFMA Treasurer, Mr R. Ramkutty warmly welcomed the delegates and attendees, expressing their gratitude for the US Grains Council (USGC's) long-standing commitment to the Indian animal hfeed industry.

Dr Harshakumar Shetty updated on the statistics of grains in India and its forecast. He also highlighted the need for alternative feed ingredients and that further study needs to be conducted on alternatives like Sorghum. Dr Shetty emphasized the importance of conducting field trials to assess its viability and its economic impact. It was extremely enlightening for the gathering on the data presented by Dr Harsha Kumar Shetty.

Mr Divya Kumar Gulati, Chairman of CLFMA of India, highlighted the pressing issues of grain and corn shortages, emphasizing the critical need to address these challenges for the sustainability of the livestock sector. As the apex chamber representing the livestock industry, CLFMA serves as the unified voice of the sector, consistently advocating for its concerns with the Government of India to secure a sustainable future. CLFMA Chairman also underscored the

R. Laxmanan
Chairman, BCC

importance of treating poultry farmers, aqua farmers and dairy farmers on par with agricultural farmers, acknowledging their significant contributions to the economy and food security. He particularly emphasized the need to spotlight poultry, dairy and aquaculture sectors for their pivotal roles in fostering growth and innovation. He appreciated the collaborative efforts within the industry to drive innovation and address key challenges.

A central topic of discussion revolved around the challenges faced by the Indian poultry industry in sourcing corn and other grain alternatives. The Broiler Coordination Committee (BCC) Chairman Mr R. Laxmanan addressed the

Gassen Plus

Bon Ammonia and obnoxious Gasses

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

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

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

COMPOSITION:
YUCCA SCHIDIGERA
ALOEVERA
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

DOCTOR'S VET-PHARMA PVT. LTD

cG.M.P. Certified an ISO 9001:2008 Company
Survey No. 263/1, 264/1, P.R. Palem (V), Kovur (M),SPSR Nellore Dist.- 524137. A.P. INDIA.
Tel. 08622 - 210902. Email: dvpl33@yahoo.com, www.doctorlifesciences.com

ANTIBIOTIC FREE,
STEROIDAL FREE.

Mr R. Ramkutty, CLFMA Treasurer

assembly, highlighting the importance of exploring alternative grain sources to ensure a sustainable supply chain. Complementing this, Mr. M.R.I. Magdum, Dr Harshakumar Shetty and Dr Nagabhushan key officials from Venkateshwara Hatcheries. further elaborated on the potential of sorghum as a promising substitute for corn in poultry diets and the need for its evaluation.

Price parity of various US grains, their derivatives and closing grain inventories were key areas of deliberation during the meeting.
As a gesture of appreciation, mementos were presented to the US Grains Council delegates and VHPL representatives by CLFMA of India, Broiler Coordination Committee and Niswin Enterprises.
The event concluded on a high note with a dinner hosted by Shanthi Feeds,

providing an excellent opportunity for networking and camaraderie among the attendees.
This collaborative initiative underscored the importance of global partnerships in strengthening the Indian poultry industry and ensuring its resilience in the face of evolving challenges.

FECPI

SOLUTION FOR SUSTAINABLE

AQUA CULTURE....

Our Products are Registered with CAA as Antibiotic-free Aquaculture Inputs

Manufactured & Marketed by

FECPI India Pvt. Ltd.

Regd. off : Sy No. 94/1A1, Ground Floor
Vanagaram-Ambattur Road, (Next To Apollo Hospital),
Ayanambakkam, Chennai - 600095
Cusstomer Care : +91 99449 88192, +91 44 495 23456
Email : info@fecpi.in Visit us at : www.fecpi.in

Visit us at : **www.fecpi.in**

BACTERIOPHAGE THERAPY FOR SHRIMP HATCHERY

V PHAGES™ HATCHERY

EFFECTIVE ON SUPERBUGS

CAA Certified Antibiotic-free Product
CAA/OCT22/PRO/04169

BENEFITS

Broodstock:
Prevents entry of opportunistic pathogens and safeguards health of this high value asset.

Artemia:
Reduces the *Vibrio sp.* load in Artemia tank.

Zoea & Mysis:
Helps in better conversion and survival.

Post Larvae:
Stagewise control of *Vibrio sp.* results in remarkable reduction of *Vibrio sp.* load in post larval tanks. This results in high health seeds.

Works as an Alternative to Antibiotics and complies with International Seafood export regulations.

BEST APPROACH TO CONTROL PATHOGENIC VIBRIOS

V PHAGES HATCHERY	✓✓
PROBIOTIC	✓
SANITISER	✗
DISINFECTANT	✗✗
ANTIBIOTICS	✗✗✗

One Health unified approach for balanced welfare of people, animals and ecosystems.

ONE HEALTH APPROACH

BACTERI THERAPY T PATHOGEN

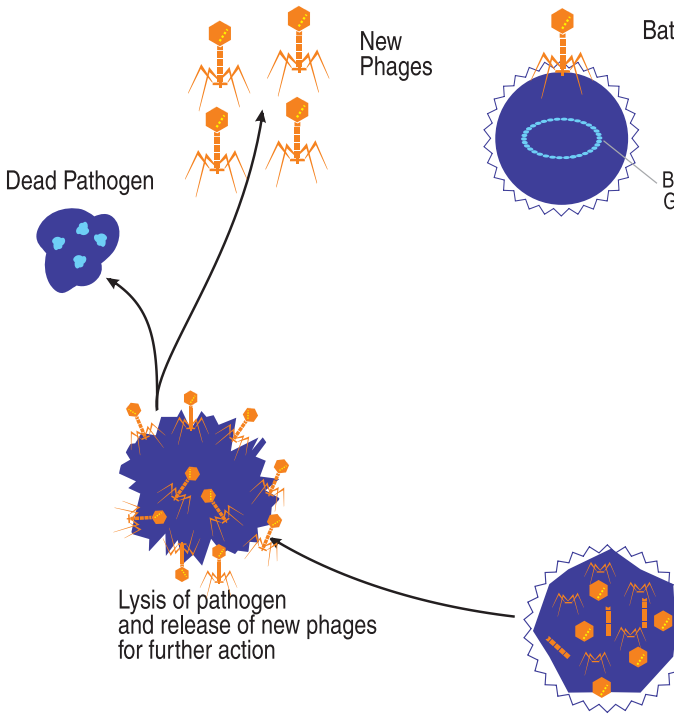
V PHAGES HATCHERY & V PHAGES GROWOUT are a co they are safe on aquatic animals, people and ecosystem resistant to antibiotics and incre

"V PHAGES" cocktail targets against most common pathog

• ***Vibrio parahaemolyticus*** • ***Vibrio alginolyticus*** • ***Vibrio h***

100 % Natural | Pathogen specific approach | V
Easy & Safe to use | Do

ILLUSTRATION OF ACTION OF PHAG



www.salemmicrobes.com

To order contact

+91 93448 37525

E-Mail : contact@salemmicrobes.com

A Product of

SALEM MICROBES

An ISO 9001 : 2015 Company

IOPHAGE
O DESTROY
IC VIBRIOS

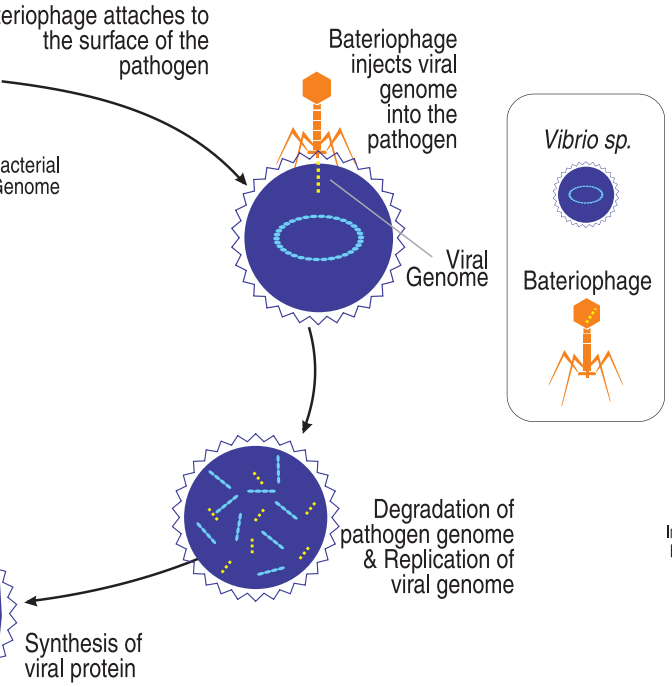
ocktail of Phages isolated from Natural environment. Hence
ns. This destroys the pathogenic bacteria which are even
eases the efficacy of probiotics.

enic *Vibrio species* in Shrimp Hatchery & Farming

arveyi* • *Vibrio campbellii and other pathogenic Vibrio sp.

Very Fast action | Enhances Probiotic performance
oes not leave any residues

GE ON A TARGET VIBRIO BACTERIA



BACTERIOPHAGE THERAPY FOR SHRIMP FARMS

V PHAGES GROWOUT™

EFFECTIVE ON SUPERBUGS

CAA Certified Antibiotic-free Product
CAA/MAR2023/PRO/04631

BENEFITS

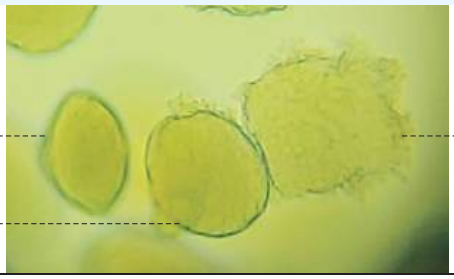
- Effective against Vibriosis, other Bacterial Infections and Running Mortality Syndrome (RMS).
- Effectively prevents Gut Infections and Improves feeding.
- Prevents sudden crop loss and extends Life of Pond during critical profit-making period.
- Enhances Probiotic performance.

Works as an Alternative to Antibiotics and complies with International Seafood export regulations.

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.

S PRIVATE LIMITED

Regd. Off : No. 21/10C, Bajanai Madam Street, Gugai, Salem - 636 006. Tamilnadu. India.
Customer Care : +91 8695145602 E-Mail : contact@salemmicrobes.com www.salemmicrobes.com

Aqua Exchange
Transforming Aquaculture with Technology

Four Engineering Professionals join together to provide better technology to Aquaculture

Veeravalli: Four Engineering professionals from different areas like Visakhapatnam, Repalle, Nellore and Srikakulam - Mr Pavan Krishna Kosaraju, Mr Kiran Kumar, Mr Kareem and Mr Hemasundar Dhavili respectively from Andhra Pradesh joined together and promoted Aqua Exchange, an embedded finance, agri-tech start-up providing a full stack of services to the farmers and other ecosystem players in the inland shrimp and fish culture industry. Its vision is to add value across the value chain using technology as a key facilitator. It designs, develops and manufactures high end technology solutions for the use of aquaculture farmers which then enables other partners such as financing institutions and insurance companies to work with the ecosystem. AquaX follows a farmer centric scalable approach with the following key services:

Engineers join together to benefit Aquaculture: *From left - Kiran Kumar, Kareem, Pavan Krishna Kosaraju and Hemasundar Dhavili, promoters of Aquaculture Exchange based at Veeravalli near Vijayawada are expected to do big things in Aquaculture which might help the farmers.*

1. **Technology Solutions** - IoT solutions for automating the operations and control of farm activities for increased productivity and reduced risks & reduced crop expenditure.

2. **Bank Loans** - Providing access to crop loans from financing institutions to enable crop loan access to hitherto unserved farming segments.

3. **Insurance Services** – A technology platform to avail crop disease insurance for the first time.

4. **Input Sales** – Access to procure the best quality inputs at the cheapest possible prices.

5. **Harvest as a Service** - Providing direct market linkages for output harvests of the farmers while ensuring the stringent quality standards and data trails required by the end consumers.

Incorporated in 2020 by Mr Pavan Krishna Kosaraju, an IIT Madras alumnus, along with Mr Hemasundar, Mr. Kareem, and Mr Kiran Kumar, Aqua Exchange is pioneering the use of technology tools such as IoT, AI and ML in aquaculture industry. Its technology solutions are being utilized in nearly 50,000 acres of farms in India, it has enabled access to formal finance to more than 150 farmers and it has facilitated disease insurance services to more than 2000 acres of crops. The company's innovations have started to transform the shrimp farming industry, setting new benchmarks in efficiency, sustainability and profitability.

Aqua Exchange Solutions

Power Mon: The Beginning of Change

Aqua Exchange introduced **Power Mon**, a system designed to monitor aerators in real-time. This technology not only improved aeration efficiency but also reduced power consumption by 20%, making it a game-changer for the aquaculture sector. To date, this innovation has been adopted by farmers managing nearly 50,000 acres of shrimp ponds wherein it has saved them expenditure on power costs to the tune of INR 10.5 crores and also reduced CO_2 emissions by a few thousand tons.

Static Feeder: Enhancing Feed Quality and Efficiency

Aqua Exchange developed a unique feed dispensing system that could dispense complex feed with top-coated feed additives. The double-walled hopper design prevents heat from affecting the feed, ensuring its quality remains intact. This innovation has made Aqua Exchange's feeders a preferred choice for maintaining feed integrity. These feeders, along with Aqua BOTs, are now being exported to Ecuador, Madagascar and Saudi Arabia, further establishing

Aqua Exchange's global presence.

Aqua BOT: The Autonomous Feeding Revolution
The introduction of Aqua BOT, an autonomous robot for shrimp feeding, marked a significant milestone. Aqua BOT autonomously navigates ponds, delivering feed in a controlled manner to ensure optimal distribution. By minimizing overfeeding and underfeeding, it improved feed conversion ratios (FCR) by 10%, leading to enhanced growth rates and reduced feed waste. This innovation significantly reduced labor costs, making shrimp farming more efficient and sustainable.

Smart Farming Tools
Identifying the need to provide assurance in terms of farming practices, Aqua Exchange developed additional smart farming technologies, including:

- **Smart Aeration Systems (Smart Starters)**
- **Feed Mixers**
- **Smart Weighing Machines**

These tools enabled farmers to monitor shrimp health, respond to issues promptly, and operate more efficiently. Aqua Exchange became a trailblazer, setting a new standard for shrimp farming in India.

Aqua Science: Proactive Shrimp Health Monitoring
The Aqua Lens system monitors shrimp and water health regularly, helping farmers take timely decisions to prevent diseases. This proactive approach has significantly enhanced shrimp farming outcomes.

NextFarm: A Path-Breaking Mobile App
The NextFarm app is a revolutionary communication tool resembling a WhatsApp-style interface. It allows farmers to:

- Monitor feed intake through check tray monitoring.
- Communicate feed adjustments to smart weighing machines.
- Schedule daily, weekly and bi-weekly applications.
- Capture data at the source for 100% traceability and reduced human error.

Centralized Monitoring and Data-Driven Precision Farming
Aqua Exchange introduced centralized control rooms for real-time monitoring of biomass and pond conditions. This enabled precision farming, allowing farmers to make accurate decisions and respond to changes quickly. The control rooms provided a comprehensive view of pond variables, including feed distribution, aeration and water quality helping maximize shrimp growth and efficiency.

Crop Loans: A Financial Safety Net

In 2022, AquaExchange pioneered crop loans for the aquaculture sector. By leveraging accurate farming data, these loans provided farmers with financial security, helping them manage their operations confidently. In order to enable financing services for farmers, AquaExchange developed the necessary infrastructure to manage lead generation & underwriting support, disbursement management, tracking end use of funds, real-time asset management and automated recovery.

Crop Insurance: A First for the Shrimp Industry
In 2024, AquaExchange launched a groundbreaking crop insurance program tailored for shrimp farmers. This insurance offered protection against disease-related losses, addressing a longstanding need in the industry. The program provided farmers with the confidence to operate without fear of devastating financial setbacks caused by unforeseen challenges. AquaExchange provides the insurance providers with support regarding policy issuance, crop monitoring and also during the claim recording and settlement processes.

AquaExchange: A Full-Stack Partner for Farmers

AquaExchange firmly believes that any meaningful impact in the agriculture sector requires a full stack approach wherein all the needs of the farmers need to be addressed. Accordingly, it has evolved into a full-stack service partner for shrimp farmers, offering:

- IoT enabled solutions for real-time crop monitoring and loss avoidance.
- AI and ML technology solutions to improve farming efficiency and increase profits.
- Loans and crop insurance to manage the financial needs and mitigate cash flow risks.
- Access to essential inputs such as high-quality seed, feed, minerals, probiotics and healthcare products.
- An easy platform to connect to the end buyers directly increasing the realization for their harvest.

Harvest as a Service
AquaExchange further identified the immediate need for an efficient harvesting process, which retains the quality of the produce while being transported to the processing plants, in order to address the data and quality requirements of the end buyers when the product is exported. Accordingly, it has developed the necessary technology solutions to harvest the shrimp efficiently and also record all the necessary data in order provide the required assurance to the end buyers regarding the quality standards of the material being supplied.

AquaExchange's innovations have

especially empowered small shrimp farmers to thrive in a competitive (which is increasingly become global) industry, securing sustainable growth and economic stability. With its technology now being adopted by a large farming community in India and abroad, AquaExchange has cemented its position as a leader in aquaculture, transforming shrimp farming for the better. In doing so, it also successfully positioned Andhra Pradesh on the global map as a pioneer in promoting technology enabled farming for improving environmental sustainability and increasing farmer profitability.

4800 Farmers using Aqua Exchange technology are arranged loans to 150 farmers in A.P

Talking to Aqua International, Mr Kiran Kumar, CBO, Aqua Exchange, said that there is no technology adoption like Internet of Things (IOT) in Shrimp Aquaculture industry. I met a couple of people in Bhimavaram in 2018. I saw a farmer with a sad face sitting in a marriage function and he lost Rs 12 lakh worth shrimp crop due to 'DO' issue as aerators in the pond were switched off. He could not notice it and entire shrimps died in one hectare. That triggered me and thought of exploring ideas to help the farmer, and then we came out with the device *Powerman* and installed it at electricity meter which will monitor and inform the farmer through mobile of aerators not working. It not only saves farmer from aerator failure but will also save power bill to the magnitude of 15-20 %, he informed.

According to him, the company will also arrange crop loan to shrimp farmers of Rs 2.5 lakhs per acre through banks and also arrange crop insurance against diseases. Now the technology is adopted by 50,000 acres of shrimp farms in Andhra Pradesh, Odisha, Tamil Nadu and Gujarat states, but 95% of it is in Andhra Pradesh.

4,800 farmers are using Aqua Exchange technology and arranged loans upto 4,500 acres

Kiran Kumar, CBO

to 150 farmers in Andhra Pradesh alone.

Aqua Exchange was established in 2020 with its headquarters at Veeravalli, near Vijayawada airport and IT office in Hyderabad. They have 330 staff members and is expanding it now. Aqua Exchange had a business turnover of Rs 100 crores in 2023 – 2024 and is expecting three times more business growth in 2024 – 2025, Mr Kiran Kumar stated. This kind of technology implementation is not there anywhere in the world in shrimp culture, he said.

A farmer who uses Whatsapp in mobile phone, can easily adopt Aqua Exchange technology for monitoring shrimp ponds, he stated.

While Pavan Krishna Kosaraju is an expert in finance modelling, Kiran Kumar is a mechanical engineer worked in Coco-Cola as design manager, Kareem is an electrical engineer and expert in product design and software, and Hemasundar is a mechanical engineer and expert in operations of companies and products, and worked in Schlumberger, ONGC and OYO.

Promoters & Partners of Aqua Exchange

1. Pavan Krishna Kosaraju – CEO & Co-Founder
   Civil Engineer from IIT Chennai.
2. Kiran Kumar – CBO & Co-Founder
3. Kareem - CIO & Co-Founder
4. Hemasundar Dhavili – COO & Co-Founder

Why Thai mangur debarred in Bihar ?

Anjali kumara
College of Fisheries Kishanganj,
Bihar Animal Science University, Bihar,
E: showkatdar53@gmail.com

The walking catfish (Clarius gariepinusis) a species of freshwater is a 3-5 foot long air-breathing catfish native to Southeast Asia. It is named for its ability to walk and wiggle across dry land, to find food or suitable environments. This fish normally lives in slow -moving and often stagnant waters in ponds, swamps, streams and rivers, as well was in flooded rice paddies or temporary pools that may dry-up. This fish need to be handled carefully when fishing it due to its embedded sting or thornlike defensive mechanisms hidden behinds its fins

Within Asia, this species has been introduced widely. It has also been introduced outside its native range where it is considered as invasive species. It consumes the food supplies of native fish and preys on their young. It is also regarded as an invasive species because they can destroy fish farm. It is a common inexpensive food item prepared in a variety of ways. It is offered by street vendors, especially grilled or fried.

Magur contains different nutritional elements such as moisture 78.25%, carbohydrates 5.53%, fat 1.06%, protein 14.15%, and ash 1.42%. Magur fish is gaining popularity among growers. Method of culture is easy. It can be grown in an adverse environment such as fewer levels of oxygen and high-water temperature. It can survive in polluted water as well. Despite a good nutritional value the fish has banned in many countries. These omnivorous magur fish prey on every single aquatic species. Not all species of magur are not equally invasive but the African catfish and Thai magur are banned in many countries because of their extremely invasive nature. Magur fish is banned in India since 2000 after several harmful impacts on indigenous fish is reported.

Why was the Thai Magur fish banned ?

Culture of prohibited exotic "thai magur" continues evicted onto the Indian platter despite a ban by the national green tribunal. The presence of these species in any water body destroys its ecological balances. It is a cannibal species that impacts the indigenous biodiversity and in turn reduces the food bases for aquatic birds. It is also believed to be carcinogenic. Thai Magur are fed rotten meat with spinach which pollutes the water bodies and carries diseases like Argulosis, commonly known as fish lice. Its consumption can increase chances of cancer. Its flesh contains 80% iron and lead that causes several serious diseases. It also contains heavy metals such as arsenic, cadmium, chromium, mercury, that causes heart related problems etc.

Why is Thai Magur still in Market ?

The growth rate of Thai magur is very high, yeilding high returns for breeders in a short time. If a local variety gains 300gm in six months, a Thai Magur grows up to a Kg within the same time. Further Input cost of breeding carp in a 1-hectare pond can be between Rs. 1.5 lak and Rs. 2 lakh in a year If a breeder switch to Thai Mahur, the yield can double because it is fast-breeding species. The fish can grow even in muddy water between the rains. Its grow 3-5 feet weigh 3-4 kg within 2-3 months. These characteristics make the cultivation of the fish easy, highly profitable and economical for farming.

In Motihari district of Bihar fisheries officer punished those

Highlights

· Molecular markers will play a major role in bringing out quality and sustainability to aquaculture.

· Molecular markers have wide range of applications in aquaculture mainly; in genetic identification and discrimination of hatchery stocks, finding out inbreeding events, assignment of progeny to parents using genetic tags.

· To finding out quantitative trait loci, marker assisted selection for selective breeding trials and assessment of the effect of polyploidy induction and gynogenesis.

sellers who sales this species in market for 6 months jail or fine with ₹ 500. In-spite, of several legal measures and bars, the species is being cultivated illegally and its sales are popularly mainly for its surviving capabilities. They are being cultivated in unhygienic condition and have enough potential to make people sick their breeding centers being destroyed.

Impact of microplastics on aquatic organisms, ecosystems and human health

N. Karthik, Anzil Rikesh and S. Felix
College of Fisheries Science, DIFST, Midalam, Kanniyakumari – 629 193.

Introduction

Over the past seventy years, there has been a significant increase in plastic production, rising from 1.5 million tons in the 1950s to 367 million tons in 2020. This surge in plastic production is closely linked to the growth of the human population, which has more than doubled from about 3.1 billion in 1961 to around 7.3 billion in 2015, projected to exceed 9 billion by 2050. The escalating demands of this population growth are expected to drive the plastics commodity market, alongside the increasing demand for fishery and aquaculture products. Estimates based on current growth rates suggest that plastic production is set to double by 2025 and more than triple by 2050. The mass production and consumption of plastics have led to the accumulation of these materials in natural habitats, resulting in adverse impacts on both biota and the economy. Approximately 275 million tons of plastic wastes were generated globally in 2010, with between 4.8 million and 12.7 million tons of this waste entering the oceans due to improper management by coastal countries. Once in the environment, plastic objects degrade into smaller fragments, entering the food chain directly or indirectly contaminating it through the leaching of potentially harmful chemicals. Microplastics and nanoplastics have been found in various foods, including seafood, beer, drinking water, honey, and salt, leading to human ingestion of these particles. To combat plastic pollution, many countries have implemented measures to eliminate or reduce certain plastic products, with 60 countries currently having banned or taxed single-use plastics.

The Microplastics

History of Microplastics

Although the presence of small plastic particles in the environment was known since the early seventies, microplastics have recently gained significant attention from the scientific community. This increased interest is reflected in the significant investments in research on microplastics globally over the last decade.

Concerns and Impact

Microplastics are a concern due to their small size, which allows them to be ingested by living organisms and eventually reach humans through contaminated food. The presence of microplastics in food was first reported in 2010.

Definitions and Classification-

There is no consensus on a broad definition for microplastics, but they are generally classified based on their dimensions. The most widely used definition is that microplastics are particles smaller than 5 mm in their longest dimension, which is the size below which ingestion by many marine species occurs. This

definition has been adopted by the NOAA and the EU's MSFD. Microplastics are also classified into primary and secondary types. Primary microplastics are intentionally produced in a size range of less than 5 mm and are intended for special domestic or industrial uses. Secondary microplastics, on the other hand, are the result of the fragmentation and degradation of larger plastics in the environment. They are estimated to be the prevalent form in the marine environment, with approximately 68,500–275,000 tons emitted annually. Secondary microplastics are estimated to constitute more than 90% of the 5 trillion microplastics floating on the sea.

Effects of Microplastics on Fish and Human Health

The effects of microplastics on fish and human health are significant. Microplastics can cause tissue damage, oxidative stress, changes in immune-related gene expression, and alterations in antioxidant status in fish. Fish exposed to microplastics may suffer from neurotoxicity, growth retardation, and behavioral abnormalities. However, the consequences of microplastics on human health are not yet fully understood.

Microplastics in Fishery Products and Human Health Risks-

The presence of microplastics in fish and fishery products poses risks to human health. While most fish species are eviscerated before consumption, direct human exposure to microplastics is considered negligible. However, studies have shown that gutted fish, excluding viscera and gills, can contain significantly higher levels of microplastics compared to excised organs. Small pelagic fish like sardines and herring, commonly consumed whole, may present a greater risk of microplastic intake. Further research is needed to understand the levels of microplastics in smaller fish species and their implications for human health.

Effects of Microplastics on Aquatic Species

The presence of microplastics in the marine environment has been shown to have significant impacts on a wide range of aquatic organisms, including commercially important fish, crustaceans, and mollusks. In fish, microplastics can cause serious physiological and behavioral issues. Studies have found that exposure to microplastics can lead to tissue damage, oxidative stress, and changes in immune-related gene expression in species like chub mackerel (Scomber japonicus) and herring (Clupea harengus). For example, a study on juvenile European sea bass (Dicentrarchus labrax) revealed that microplastic ingestion resulted in neurotoxicity, growth retardation, and behavioral abnormalities, potentially affecting their survival and ecosystem function .Crustaceans, such as the commercially important brown shrimp (Crangon crangon), are also susceptible to the effects of microplastics. Research has shown that swimming crustaceans like shrimp may ingest more microplastics than sessile species, as they are more likely to encounter and consume these small plastic particles. A study on brown shrimp in the English Channel found that 63% of the samples contained synthetic fibers, with seasonal variations in microplastic absorption . Bivalve mollusks, including mussels and oysters, are particularly vulnerable to the impacts of microplastics due to their filter-feeding nature. Studies have detected microplastics in species like the blue mussel (Mytilus edulis) and the Mediterranean mussel (Mytilus galloprovincialis), with concentrations ranging from 0.26 to 0.51 particles per gram of mussels . These microplastics can have direct and indirect effects on the physiology, habitat structure, and food sources of these bivalves, potentially affecting their overall health and ecosystem function.The widespread contamination of commercially important aquatic species with microplastics highlights the urgent need for further research, effective mitigation strategies, and enhanced awareness to address the environmental and health risks associated with this emerging pollutant.

Potential Health Risks from Microplastic Exposure

Toxicity of Microplastics

Microplastics can pose various health risks to organisms due to their physical characteristics and the chemicals associated with them. Studies have shown that microplastics can cause oxidative stress, cytotoxicity, and translocation to other tissues in exposed organisms . Prolonged exposure can lead to chronic inflammation, cell proliferation, necrosis, and impairment of immune cells. Microplastics can also release chemicals, such as additives and persistent organic pollutants,

that were previously adsorbed on their surfaces .

Exposure through Seafood Consumption

Fishery products are a known source of microplastic contamination in the human diet. Estimates suggest that the annual intake of microplastics through the consumption of fish, crustaceans, and bivalves can range from 112 to 842 particles per year, according to EFSA, and 518 to 3,078 particles per year, according to EUMOFA and NOAA . The degree of microplastic pollution and seafood consumption varies significantly between countries, leading to different levels of exposure. For example, in European countries with high bivalve consumption, the estimated intake can reach up to 11,000 particles per year, while in countries with lower consumption, the average is around 1,800 particles per year .

Uncertainties and Knowledge Gaps

Despite the growing evidence of microplastic contamination in seafood, the actual amount of microplastics to which humans are exposed remains uncertain. This represents a fundamental parameter for assessing the potential health effects of microplastics. Additionally, the risks associated with the absorption of contaminants and additives from microplastics are not yet fully understood, and more research is needed to characterize the potential impacts on human health.

Conclusion

The proliferation of plastic production over the past decades has led to a concerning rise in microplastic pollution, with significant implications for both aquatic species and human health. The exponential growth in plastic production, driven by population expansion and increasing demands, has resulted in the generation of vast amounts of plastic waste, a substantial portion of which finds its way into the oceans. Microplastics, defined as particles smaller than 5 mm, have emerged as a critical environmental issue due to their ability to be ingested by marine organisms and subsequently enter the human food chain. The adverse effects of microplastics on fish and aquatic species are well-documented, ranging from tissue damage and oxidative stress to behavioral abnormalities and neurotoxicity. Commercially important species like fish, crustaceans, and mollusks are particularly vulnerable to the impacts of microplastics, which can disrupt their physiology, habitat structure, and overall ecosystem function. Moreover, the presence of microplastics in seafood poses potential health risks to humans, with estimates indicating varying levels of microplastic intake through fishery products consumption. Despite the progress in understanding microplastic contamination, there are still uncertainties and knowledge gaps surrounding the extent of human exposure to microplastics and the associated health risks. Further research is crucial to elucidate the full scope of the impacts of microplastics on human health and the environment, emphasizing the need for enhanced awareness, effective mitigation strategies, and global cooperation to address this pressing environmental challenge.

Challenges and solutions in Meghalayan aquaculture: Advancing hill aquaculture through technological innovation and social inclusion

Chandan Debnath, Bankitkupar Mukhim, S. Gojendro Singh

Division of Animal and Fisheries Sciences, ICAR Research Complex for NEH Region, Umiam, Meghalaya

KVK (ICAR), Ri Bhoi district, Meghalaya, chandannath23@gmail.com

Abstract

This article examines challenges and solutions in Meghalaya's hill aquaculture sector, where current production of 18,000 MT falls significantly short of the 36,360 MT regional requirement. The study identifies key environmental constraints, including suboptimal temperature regimes and soil acidity, while highlighting innovative solutions such as polyhouse systems that maintain temperatures 2.4°C higher than open systems. The article evaluates species-specific adaptations, with Barbonymus gonionotus and Labeo gonius showing particular promise. The analysis also addresses disease management, water quality, and

feed innovations, emphasizing the sector's unique opportunity to leverage women's participation through Meghalaya's matrilineal social structure. The findings suggest that integrating technological innovations with traditional knowledge and regulated recreational fishing practices can enhance sector sustainability.

Introduction

The aquaculture sector in Meghalaya faces a substantial production deficit, with current output at 18,000 MT significantly below the regional requirement of 36,360 MT. This gap holds particular significance as over 22,000 individuals depend on fisheries for their livelihoods. The state's distinctive matrilineal social structure presents a unique opportunity for sector development, as historical evidence suggests that women's participation in agricultural enterprises often correlates with higher success rates and improved productivity outcomes. The integration of traditional knowledge with modern aquaculture practices creates a foundation for sustainable development in the region.

Environmental challenges and adaptations

The aquaculture environment in Meghalaya presents complex challenges that require innovative solutions. The primary constraint is the suboptimal temperature regime, with average annual water temperatures ranging between 20-22°C, significantly below the preferred range for traditional warm-water aquaculture species. This temperature limitation necessitates the development of adaptive strategies and careful species selection, particularly

Fish farming as a livelihood enterprise in Meghalaya is gaining popularity

in higher elevation areas where temperature fluctuations become more pronounced.

Current research at ICAR Meghalaya on Neolissochilus hexagonolepis (chocolate mahseer) demonstrates that polyhouse-based aquaculture systems represent a transformative solution to temperature constraints. These systems maintain water temperatures 2.4°C higher than open systems on average and 3.2°C higher during critical winter months. For N. hexagonolepis, this temperature optimization results in significant production improvements, with growth rates increasing by 34.6% and survival rates improving by 16.1% compared to conventional open pond systems. The implementation of polyhouse systems also provides additional benefits, including better control over water quality parameters and reduced predation risks.

Species selection proves crucial in maximizing production under these conditions. Barbonymus gonionotus (Silver barb) demonstrates exceptional adaptability to hill conditions, exhibiting remarkable temperature tolerance across a range from 15°C to 41.5°C while maintaining optimal growth between 25-30°C. B. gonionotus shows particular promise in hill aquaculture systems, achieving consistent growth rates of 0.7-0.8 g/fish/day and reaching marketable size within 3-4 months. Its versatility extends to various culture systems, including cage culture in open waters and integrated farming systems, making it an invaluable addition to hill aquaculture portfolios in Meghalaya.

Labeo gonius (Kurio Labeo) emerges as another important species for hill aquaculture systems. L. gonius exhibits superior survival rates compared to other carp species and performs exceptionally well when co-cultured with L. rohita (Rohu) under proper feed management. The species' bottom-dwelling characteristics and notable resistance to water pressure further establish its value in hill aquaculture operations, particularly in deeper

Polyhouse-based aquaculture system developed by ICAR, Meghalaya

ponds where water pressure can affect fish performance.

The challenge of soil acidity presents another significant hurdle, manifesting in both direct and indirect effects on aquaculture production. Acidic soil conditions contribute to water acidification, creating physiological stress for fish populations. This stress is further complicated by specific toxicity issues: iron toxicity predominantly affecting lowland aquaculture operations and aluminum toxicity impacting upland systems. These metal toxicities can severely compromise fish growth and survival rates, necessitating sophisticated management strategies and regular monitoring protocols.

Disease management and health solutions

Winter months present particularly severe challenges for hill aquaculture operations, with Saprolegnia infections becoming highly prevalent during temperature drops. Recent research reveals important patterns in species-specific disease susceptibility, with Cyprinus carpio (Common carp) showing the highest susceptibility to parasitic infections at 44% prevalence, while Catla catla demonstrates remarkable resistance. This understanding leads to more targeted and effective disease management strategies, including species-specific prophylactic measures and treatment protocols.

Contemporary observations in Meghalaya highlight angling-induced stress as an emerging concern in pond-based aquaculture systems, where recreational fishing activities are increasingly

Saprolegnia-infected fishes

common. Studies indicate that repeated exposure to angling activities significantly impacts fish physiological responses and immune function. The frequent disturbance from casting and retrieval of fishing lines disrupts natural feeding patterns and increases cortisol levels in fish, making them more susceptible to diseases. In monitored ponds with regular angling activities, fish show elevated stress markers and a 23% higher incidence of secondary infections compared to non-angling ponds. The combination of handling stress, hook-related injuries, and disrupted feeding behaviors reduces growth rates by up to 18% and increases mortality rates, particularly during winter months when fish already experience temperature-related stress.

Fish ulcers

Innovative solutions utilizing local resources show promising results in disease management and health improvement. Turmeric extract supplementation, particularly using the locally developed 'Megha turmeric-1' variety, demonstrates significant benefits in enhancing fish immunity and stress resistance. Current research shows that incorporating 2% turmeric extract in feed improves survival rates of L. gonius from 78.4% to 88-90% under suboptimal temperature conditions. The study reveals enhanced hematological parameters, including increased red blood cell counts, white blood cell counts, and hemoglobin levels, indicating improved stress tolerance and immune response.

The implementation of controlled environment systems proves particularly effective in mitigating winter-related health challenges. These protected cultivation structures not only help maintain optimal temperatures but also provide better control over water quality parameters, resulting in survival rates exceeding 80% compared to conventional systems. The integration of water quality monitoring systems with disease surveillance protocols enables early detection and rapid response to potential health issues.

Water and soil management strategies

Despite high rainfall in the region, water retention remains a critical challenge in hill aquaculture operations. The implementation of effective water harvesting systems becomes crucial, particularly when combined with strategies to manage soil and water acidity. Regular liming practices, properly sized drainage systems, and the use of organic buffers prove effective in maintaining optimal pH levels for aquaculture production. Advanced water management techniques, including the use of biofilters and sediment traps, help maintain water quality while minimizing water exchange requirements.

For lowland areas affected by iron toxicity, the implementation of advanced aeration systems and proper drainage design helps oxidize and precipitate excess iron. Mechanical aeration, combined with strategic pond design, creates oxidized zones that facilitate iron precipitation and removal. In upland areas, aluminum toxicity management requires careful pH control and the strategic use of organic matter to bind free aluminum ions. The application of organic amendments, including locally available agricultural byproducts, helps create more favorable conditions for fish growth and survival.

Feed innovation and resource utilization

The identification of Crassocephalum crapidoides (fireweed) as a potential feed ingredient represents a significant breakthrough in local feed development. With protein content exceeding 20%, this locally available shrub effectively replaces up to 61.3% of conventional protein sources in fish feed without compromising fish health or growth performance. When incorporated at moderate levels (25-50% replacement), it shows potential to improve growth rates while reducing feed costs by up to 15.5%. This innovation demonstrates the value of exploring local biodiversity for sustainable aquaculture solutions.

Species-specific feed management strategies demonstrate remarkable success in optimizing growth and efficiency. Carefully formulated feeds produce specific growth rates of 1.52-1.53% per day in L. gonius, representing a 47.5-48.5% improvement over conventional feeds. This growth

Capacity-building program for tribal farmers at the ICAR Meghalaya Fish Farm under the Scheduled Tribe Component (formerly Tribal Sub-Plan)

enhancement, combined with improved survival rates, indicates that appropriate feed management can significantly offset the challenges posed by suboptimal temperature conditions. The development of season-specific feed formulations further enhances the effectiveness of feeding programs, accounting for variations in metabolic requirements across temperature ranges.

Implementation framework and future prospects

The development of hill aquaculture in Meghalaya requires a comprehensive approach that integrates environmental considerations with socioeconomic factors. Key development areas include establishing demonstration units for polyhouse systems, particularly targeting women farmers; developing standardized protocols for managing acid stress and metal toxicity; creating feed production units utilizing local resources; implementing sophisticated water quality monitoring systems; and providing species-specific management training. The emphasis on capacity building and technology transfer ensures sustainable adoption of improved practices. The future of hill aquaculture in Meghalaya lies in expanding polyhouse systems with government support, developing locally adapted feed formulations, establishing breeding programs for temperature-tolerant species, creating women-led enterprises, and implementing integrated farming systems. This approach, combining traditional knowledge with modern techniques and emphasizing women's participation, creates a strong foundation for sustainable aquaculture development. The integration of digital monitoring systems and decision support tools further enhances management efficiency and production outcomes.

Conclusion

The successful development of Meghalaya's aquaculture sector requires a balanced approach that addresses both environmental challenges and social opportunities while leveraging local resources and traditional knowledge. Through the consistent implementation of recommended strategies, including proper regulation of recreational angling activities to minimize stress on fish populations, and maintenance of flexibility to adapt to changing conditions, the sector can work toward closing the current production deficit while ensuring long-term sustainability. Success depends on the

integrated application of technological innovations, effective resource utilization, and inclusive social strategies, with particular emphasis on enhancing women's participation in the sector and establishing clear guidelines for sustainable recreational fishing practices that do not compromise aquaculture productivity. The development of resilient aquaculture systems that can adapt to environmental challenges while maintaining productive efficiency represents a crucial step toward achieving food security and economic development in the region.

Improving Finfish Aquaculture: Recent Advances in Genetics and Breeding

J.Magimai John Jose, S.Selvaraj, A. Jackqulin Wino and R.Jeya Shakhila *UG Scholar, Assistant Professor and Head i/c, Assistant Professor, Dean Department Of Aquaculture, TNJFU-Dr.MGR Fisheries College And Research Institute, Ponneri, 601 204, Thiruvallur district, Tamilnadu *Corresponding Author's Email:magimaimadha003@gmail.com*

Introduction:

The fisheries and aquaculture sector plays a crucial role in food security, livelihoods, and economic development, providing millions of people with food, nutrition, income, and employment. Aquatic foods account for 17% of animal protein globally, with over 50% in Asia and Africa. The sector employs 58.5 million people in primary production, with 21% of them being women. In 2021, total fisheries and aquaculture production worldwide reached 218 million tonnes, with 91.2 mt from capture fisheries and 90.9 mt from the aquaculture sector. Mariculture, which involves the cultivation of marine organisms in seawater, is projected to contribute over 60% of seafood by 2030 (FAO, 2024).

India has been a pioneer in aquaculture since the 1970s, with efforts focusing on seaweed and bivalve cultivation. ICAR-CMFRI is working on standardizing seed production techniques and farming marine finfishes/shellfishes, Integrated Multitrophic Aquaculture (IMTA), and Recirculating Aquaculture System (RAS). Mariculture in coastal and offshore waters is crucial for supporting seafood production, enhancing food security, and supporting coastal communities. To develop mariculture in India, standardized seed production techniques with growth rate, market demand, and price are required. ICAR-CMFRI has designed sea cages and demonstrated the potential of marine finfish culture in galvanized iron (GI) cages and high-density polyethylene (HDPE) cages.

Disease-free, high-quality hatchery-produced seeds are essential for mariculture development in India. Finfish aquaculture is one of the fastest-growing sectors in global food production, playing a vital role in addressing the increasing demand for high-quality protein. However, the industry faces challenges such as disease outbreaks, limited growth rates, environmental sustainability con

- **Advancements in finfish genetics and breeding are revolutionizing aquaculture into a sustainable and resilient sector.**
- **Latest methodologies include selective breeding, hybridization, molecular techniques, and genome editing.**
- **Selective Breeding: Significant improvements in species like Atlantic salmon, tilapia, and carp, with annual growth gains of up to 20%.**
- **Hybridization: Utilizes heterosis to produce robust and high-performing hybrids.**
- **Genome Editing: Tools like CRISPR-Cas9 and TALENs enable precise modifications for traits such as growth and disease resistance.**
- **Molecular Breeding Techniques: Marker-Assisted Selection (MAS) and Quantitative Trait Loci (QTL) mapping accelerate sustainable aquaculture practices.**
- **Reproductive Biotechnologies: Innovations like cryopreservation, monosex population production, and germ cell transplantation improve broodstock management and resource conservation.**

cerns, and resource inefficiencies. Advancements in genetics and breeding have become pivotal in enhancing finfish aquaculture, resulting in healthier, more resilient, and higher-yielding fish populations (Anuraj et al.2024).

Selective Breeding Programs: Selective breeding programs in finfish aquaculture have been instrumental in improving genetic traits such as faster growth, improved feed conversion, disease resistance, and environmental adaptability (Table.1). By carefully selecting and breeding individuals with superior traits over multiple generations, farmers can develop more productive and resilient fish populations. Traditional selective breeding methods include trait selection, mass selection, and family-based selection.Growth performance has been significantly improved through selective breeding, with species like Atlantic salmon, tilapia, and carp experiencing 10-20% annual improvements. Feed efficiency has also been enhanced, with disease-tolerant strains developed to resist pathogens like sea lice and bacterial infections. Advanced selective breeding techniques include marker-aided selection (MAS), genomic selection (GS), and hybridization.Case studies of successful breeding programs include Atlantic Salmon, Nile Tilapia, and Common Carp. Atlantic Salmon has shown significant improvements in growth, disease resistance, and product quality, while Nile Tilapia has achieved faster growth and better survival rates. Common Carp has developed strains with improved disease tolerance and faster growth. However, challenges in selective breeding include inbreeding and genetic diversity, environmental adaptability, and long breeding cycles. Future directions include integrating traditional methods with genomic tools, focusing on sustainable breeding practices, and breeding climate-resilient strains. Selective breeding programs continue to be a vital tool in advancing finfish aquaculture, offering sustainable solutions for improving productivity, profitability, and environmental stewardship.

S.No	Species	country	Traits	Year	Method of Selection	Remark
01)	Tilapia	Malaysia	Growth rate	2009	Pedigree selecton	Cumulative genetic gain of about 14% in harvested weight.
	Nile-Tilapia	Species	Species	2017	Within Family Selection	Research suggests that S. iniae and S. agalactiae are antigenically distinct vs vaccination.
	Nile-Tilapia	Species	Species	2013	Indirect selection	The values of genetic correlations and ranking indicated a strong association between genetic traits
	Nile-Tilapia	Species	Species	2017	Indirect selection	The Nile-Tilapia population exhibited a genetic response ranging from 10% to 14% per generation across various environments over five generations.
	Tilapia	Species	Species	2014	Indirect selection	The cumulative realized selection response across three generations of selection was 8.85%.
	Tilapia	Species	Species	2014	Family selection	The Nile tilapia population has shown significant and sustained genetic progress in harvested body weight after four generation fo selection under brackish water

02)	Atlantic salmon	Norway	Disease resistant	2008	Pedigree selection	The weak genetic correlation indicates that it should be relatively easy to improve resistance to each of the discoveries simultaneously.
	Atlantic salmon	camada	Preliminary Assessment of the environment	1998	Mass selection	When captive & wild smolts were analysed as are cohort, the ratio of the effective to census number of breeders was higher than that of just the breeder that prepared the wild smolts.
	Atlantic salmon	Norway	Disease resistant	2008	Within family selection	The genetic response of CRIT1 & CRIT4 leads to improved disease survival after 10 generations, while CRIT2 & CRIT3 increase with increased generation and phenotype correlation between traits 1 & 2.
03)	Atlantic salmon	Norway	Resistance against infection pancreatic necrosis	2007	Family selection	A)/B) group were 29.3% /66.6% &32.0%/79.0% in fresh water & sea water respectively
	Salmon	Norway	Growth rate	1978	Family selection	This paper reveals significant differences in fish growth rates across fish farms, primarily due to varying management strategies and food and feeding ratios.
	Coho salmon	USA	Growth rate	1990	Family selection	This study represents >60% increase in weight in four generations.
	Coho salmon	USA	Early spawning date	2006	Family selection	TAfter four generations of selection, the parent estimate for harvest weight decreased by 13 and 15 days in the even and odd year, respectively.
	Coho salmon	Canada	Growth rate	2005	Mass selection	The study reveals that a significant genetic increase in intrinsic growth rate significantly impacts the early development of Coho salmon, affecting emergency timing and survival growth rate.
04)	Rohu	India	Disease Resistant	2014	Individual selection	High stocking density play a significant predisposing factor for bacterial pathogenesis since it promotes stress in fish.

	Rohu	India	Resistance to Aeromonas hydrophila	2011	Individual selection	The first generation of resistant line showed a higher survival (56.67% over in susceptible line in the challenge test.These results show clearly the inheritance of the resistance trait in genetic lines of rohu.
04)	Atlantic cod	Norway	Simultaneous analysis	2003	Combined family & individual selection	The result presented here indicate that the GM03, GM08, GM019, GM034. GM035, etc. microsatellite loci may be reliable make for assessing genetic variation in Atlantic cod.
05)	Common Carp	China	Growth rate	2015	Pedigree	Direct gain in body weight
					selection	averaged 7% of the base population per generation (two) year.
	Common Carp	Vietnam	Survivability	2011	Family selection	This study demonstrates the application & effectiveness of molecular parentage assignment as a tool in a selective breeding programme for common carp in Vietnam.
	Common Carp	Serbia	Estimate the heritability & Genetic correlation between weight, lenght and height	2010	Within Family Selection	The heritability estimation in the first were significant different from zero, varies between 0.34 & 0.45, in second production year heritability moderate high 0.44-0.49 Genetic correlation between weight & height & between weight, were very high 0.81 & 0.01, and in second production year it varies from 0.64 & 0.74 respectively.
	Common Carp	France	Growth rate	2003	Family & Individual selection	New methodologies like microsatellite for parentage assignment in common carp allow for deeper understanding of within strain genetic variation traits, improving past moderate success.
	Common Carp	Russia	Disease resistance	1993	Mass selection	The results of the pond test were more evident variation in resistance to disease, viably and growth rate was very high. A positive correlation between the level of resistance & the initial weight of fish was established.

06)	Rainbow trout	Denmark	Disease resistant	2005	Family selection	Results support theadditive genetic variation for resistance to ERM, RTFS, &VHS.
	Rainbow trout	Norway	Genetically improve flesh composition & colour in large rainbow trout	2008	No Method indicated	Our results indicate that image analysis can be used to genetically improve fish quality. The benefit of image analysis over many other methods is that it is a cost-effective wat to access both lipid & protein percent.
	Rainbow trout	Finland	Growth rate	2005	Individual and family selection	Estimation of breeding valves across the generation showed the multi trait selection has produced an average of 7% genetic gain per generation in fresh & sea water growth of market size fish.
07)	Arctic Char	Sweden	Growth rate	2010	Combined selection	The growth increase of 8% over a single generation for 1.5 year-old fish, male & female fish appear have responded differently to size selection across replicate selection breeding programme of around 13% in 1st generation.
08)	Asian Seabass	Australia	Growth rate	2010	Within family selection	The simulation model predicts initial means response in growth rate.
	Asian Seabass	Vietnam	Genetic Evaluation of three tait-body weight, total length, survival	2018	Pedigree selection	The weight and length of the fish increased steadily until 270 dph after which there was a rapid increase in growth rate until the harvest - the survival trait during grows out phase (105 to 360 days) 30 to 100% among 30 families & the averaging (48.1%).
09)	Red Sea Bream	Japan	Growth rate	1996	No Method indicated	The average realized heritability, which was determined by the average body weight of 4-year-old brood stock & body weight of 4-year-old fish weight of 4-year-old fish in growth curve of each generation was 0.33+-0.28.
10)	Channel catfish	USA	Growth rate	2003	Individual selection	On average, there was an increase of 8.3% in body weight per generation.

Source:(Table.1).Kashyap et al.; J. Adv. Biol. Biotechnol., vol. 27, no. 7, pp. 618-631, 2024; Article no.JABB.118017.

Genetic Improvement Through Hybridization:

Hybridization is a genetic improvement technique in finfish aquaculture that combines desirable traits from two different species or strains to produce superior offspring. (Table.2). This method leverages heterosis or hybrid vigor, where hybrids exhibit enhanced growth, disease resistance, environmental adaptability, and overall performance compared to their parent species. There are three types of hybridization: intraspecific, interspecific, and polyploidy induction.Advantages of hybridization include enhanced growth rates, improved disease resistance, environmental adaptability, better feed conversion efficiency, and sterility control. Successful examples of hybridization include the Channel Catfish (Ictalurus punctatus × Ictalurus furcatus), the Tilapia (Oreochromis niloticus × Oreochromis aureus), and the Triploid grass carp (Ctenopharyngodon idella) for aquatic weed control without uncontrolled reproduction.However, challenges of hybridization include reproductive barriers, genetic instability, ethical and ecological concerns, and market acceptance. Interspecific crosses may result in poor fertility or sterile offspring, while genetic instability may cause unpredictable traits. Ethical and ecological concerns arise from the escape of hybrids into the wild, and consumer preference may lean towards traditional species, affecting hybrid product demand.Future prospects in hybridization include integration with genomic tools, developing climate-resistant hybrids, targeted trait development, and sustainable.

aquaculture. Hybridization remains a powerful tool in genetic improvement for finfish aquaculture, offering innovative solutions to enhance productivity, sustainability, and resilience in the face of growing environmental and market challenges.

S.No	Hybrids	Characteristics, Effects, And Advantages
1)	**Cyprinid fishes**	
	Rohu catla *(L.rohita x L.catla)*	Hybrid is hardy and combines first growth of catla with desirable small head shape of rohu.
	Catla x fringe-lipped peninsular carp *(L.catla x L.fimbriatus)*	Hybrid has desirable head and body shape, improved dressing percentage, and growth performances similar to those exhibited by catla.
	Silver carp x bighead carp *(H.molitrix x A.nobilis)*	Hybrids are fertile and exhibits positive heterosis in growth. Pure lines may have disappeared because of the fertility of hybrids. Food and feeding strategy is intermediate to parental species.
	Grass carp x bighead carp *(C.idella x A.nobilis)*	Hybrids are generally sterile and functional triploids with higher growth rates.
	Common carp x catla *(C.carpio x C.catla)* *Common carp x mrigal (C.carpio x C.mrigala)*	Hybrids are usually functional triploids and sterile, having higher growth and survival in monoculture practices and with good seinability
02	**Tilapia fishes**	
	Nile tilapia x blue tilapia *(O.niloticus x O.aureus)*	Hybrids of some strains yield all-male offspring with superior growth. Some hybrids are fertile with increased cold and salinity tolerance. Reciprocal cross gives 50% males and females.

	Nile tilapia x long-finned tilapia *(O.niloticus x O.macrochir)*	Hybrid yields predominately male offspring, but strain of Nile tilapia is important for good fry production.
	Nile tilapia x Wami tilapia *(O.niloticus x O.hornorum)*	Hybrid yields predominately male offspring with some strains
	Mozambique tilapia x Nile tilapia *(O.mossambicus x O.niloticus)*	Recognized as Taiwan red with higher salinity tolerance; progeny of these hybrids display a variety of different skin colors.
	Mozambique tilapia x Wami tilapia *(O.mossambicus x O.hornorum)*	Hybrid yields predominately male offspring and are fertile. Certain strains produce Florida red tilapia with salinity tolerance and good growth.
03	**Salmon and Trout**	
	Atlantic salmon x brown trout *(S.salar x S.trutta)*	Triploid hybrid exhibits the higher growth and survival to a comparable level to Atlantic salmon, but offspring becomes sterile.
	Brown trout x brook trout *(S.trutta x S.fontinalis)*	Hybrid known as tiger trout is sterile, with low early survival, but grows well in later stages.
	Rainbow trout x char trout (O.mykiss x Salvelinus sp.)	Hybrid shows increased disease resistance to salmonid viruses.
	Lake trout x brook trout (S.namaycush x S.fontinalis)	Hybrid commonly recognized as splake, and is fertile, fast growing, and tolerant of acid water.
	Chum salmon x Chinook salmon (O.keta x O.tshawytscha)	Triploid hybrids have early seawater tolerances
	Hybridization among the Pacific salmons (Oncorhynchus spp.)	Majority of the diploid hybrids are not useful for aquaculture, but have potential for disease resistance, sterility, and early seawater tolerance when the diploid hybrids are made triploid. These are also useful for production of all-female using denatured sperm and rediploidized eggs.

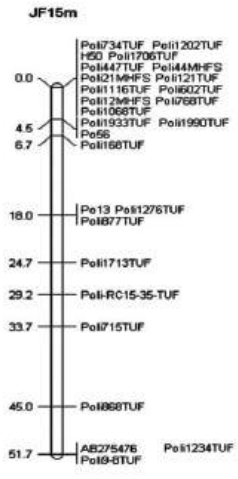
(Table.2).Source: Rahman et al.2019

Molecular Breeding Techniques:

These methods involve identifying, selecting, and modifying genetic traits to develop fish with superior growth rates, disease resistance, feed efficiency, and environmental adaptability. By integrating molecular tools into breeding programs, aquaculture can achieve faster and more sustainable genetic progress compared to traditional methods. Marker-Assisted Selection (MAS) uses molecular markers (DNA sequences) linked to desirable traits to select broodstock with superior genetics.This accelerates selective breeding by reducing reliance on visible traits and increases accuracy in trait selection, even for traits expressed later in life.A new Japanese flounder population was created using marker assisted breeding using the Poli9-8TUF allele **(Fig.1)**, which is responsible for resistance to lymphocystis disease. The B-favorable allele was transmitted to the LD-R+ population, which showed no incidence of LD at two commercial fish farms. This strategy shows that marker-assisted breeding using molecular markers is an efficient breeding strategy. MAS-lymphocystis disease resistant flounder have a market penetration rate of 35% in Japan **(Ozaki et al.2012).** Genomic Selection (GS) analyzes genome-wide genetic data to predict the breeding value of individuals for multiple traits, improving complex traits like growth rate, fillet quality, and stress resistance simultaneously. Quantitative Trait Loci (QTL) mapping identifies specific genomic regions associated with quantitative traits, enabling precise identification of genetic

regions controlling important traits and facilitating targeted breeding strategies. Transcriptomics and gene expression analysis study RNA transcripts to understand gene expression patterns in response to environmental and physiological conditions, helping discover functional genes controlling key traits and providing insights into fish adaptation to farming conditions. Epigenetic modifications involve heritable changes in gene expression without altering the DNA sequence, often influenced by environmental factors, improving stress tolerance and disease resistance by modifying gene expression. DNA barcoding and genetic stock identification use specific genetic markers to identify species and genetic stocks, preventing inbreeding and maintaining genetic diversity in breeding programs. However, there are limitations and challenges, such as high costs, technical expertise, limited regulations for genetic modifications in aquaculture, and robust data management systems for large-scale genomic data.

Genome Editing Technologies:
These technologies enable scientists to enhance traits such as growth rate, disease resistance, stress tolerance, and environmental adaptability, contributing to sustainable and efficient aquaculture practices.CRISPR-Cas9 technology is a powerful and precise genome editing tool that can cut and modify specific DNA sequences, enhancing growth rates and disease resistance. TALENs are engineered enzymes that bind and cut specific DNA sequences, enabling targeted genetic modifications. They can be used to modify growth-regulating genes for enhanced yield and disease resistance by altering immune system genes.Zinc Finger Nucleases (ZFNs) are synthetic proteins that combine DNA-binding zinc finger domains with a DNA-cutting enzyme to modify specific genes. They are used in early-stage research on genetic improvements in fish species but are less flexible and more expensive than CRISPR.Gene Knockout and Knock-in techniques are used to disable specific genes or insert beneficial genes to introduce desirable traits, such as disease resistance. Applications include knockout of fertility genes to produce sterile fish and knockout of growth-promoting genes for faster development.The advantages of genome editing in aquaculture include rapid genetic improvement, precision, disease resistance, environmental safety, and resource efficiency. By enhancing feed conversion and growth, these technologies contribute to sustainable and efficient aquaculture practices.



Genetic linkage maps of significant loci in linkage group JF-15 in Japanese flounder. Map distances between markers are shown in centimorgans (cM). A LOD of 3.0 was used to create linkage groups of each family. Map figures were drawn using MapChart ver.2.0.

(Fig.1).Source: Ozaki et al.2012

Reproductive Biotechnology In Finfish:
It involves the use of advanced biotechnological tools to control fish reproduction, produce high-quality broodstock, conserve genetic resources, and prevent uncontrolled breeding in open waters. Induced breeding techniques involve artificial stimulation of fish spawning using hormonal treatments to control breeding cycles. Techniques include hormone induction, cryopreservation of gametes, monosex population production, polyploidy induction (triploidy and tetraploidy), hybridization, genetic sex determination and control, germ cell transplantation (GCT), and genetic containment and biosafety.Hormonal induction uses hormones like gonadotropin-releasing hormone (GnRH) analogs and human chorionic gonadotropin (hCG) to stimulate ovulation and spermiation.A review of LHRHa's use in induced breeding of fishes in India found it mainly applies to high-value brackish water and marine fish species. The study found that LHRHa is used alone or in combination with HCG, PGE, 17α-MT, and Pimozide, with a typical dosage of 20-70 µg/kg for females and 10-40 µg/kg for males. Experiments are mainly conducted by ICAR-CIBA and ICAR-CMFRI (Roy K.2016). Cryopreservation of gametes preserves genetic diversity and year-round availability of high-quality gametes. Hybridization crosses-breeds between different species or strains to combine desirable traits, leading to better survival and performance. Genetic sex determination and control involve

manipulating genetic pathways to control fish populations, such as gene editing (CRISPR-Cas9) and YY-Male Technology.Germ cell transplantation transfers germ cells from donor fish to sterile recipient fish, allowing propagation of endangered species and mass production of high-value species. Genetic containment and biosafety aim to prevent unintended breeding and ecological impacts by using reproductive biotechnologies. Strategies include sterile fish production and biological containment, protecting natural ecosystems from genetic contamination and preventing the spread of farmed fish into wild populations.However, challenges in reproductive biotechnology include ethical concerns, environmental impact, regulatory issues, and technical limitations. Challenges include public resistance to genetic manipulation and hormone use, potential ecological risks if modified fish escape the wild, strict regulations on genetically modified and hormone-treated fish, and high costs and specialized expertise.

Challenges In Genetic Breeding of Finfish:

Genetic breeding of finfish has significantly advanced aquaculture by enhancing growth rates, disease resistance, and environmental adaptability. However, the process faces several challenges, including genetic diversity loss, complexity of target traits, long breeding cycles, disease risks in selective breeding, environmental and ecological concerns, technical and resource constraints, ethical and regulatory challenges, off-target effects of genetic modification, adaptation to climate change, intellectual property and access to genetic resources, and biopiracy concerns.Genetic diversity management involves implementing rotational breeding and crossbreeding programs to maintain genetic variation. Advanced genomics can be used for complex trait improvement, while containment strategies involve triploidy and sterile fish production to prevent ecological risks. Public engagement and global collaboration encourage international cooperation for responsible genetic resource management and regulation. Ethical and regulatory concerns include public apprehension about genetically modified fish and animal welfare issues, stringent laws governing the use of genetically modified organisms (GMOs), and navigating ethical debates and complying with diverse international regulations. Unintended consequences of genetic modification include off-target effects and trade-offs between traits.Adaptation to climate change requires developing genetically resilient strains that can thrive in changing environmental conditions. Intellectual property and access to genetic resources can limit accessibility, and biopiracy concerns involve exploiting native genetic resources without fair compensation to local communities. Addressing these challenges requires genetic diversity management, advanced genomics, containment strategies, public engagement, and global collaboration.

Role Of Other Natural And Synthetic Hormones:

Hormones are integral to the facilitation of reproduction in fish, with Gonadotropin-Releasing Hormone analogues (GnRH analogues) frequently utilized alongside dopamine antagonists to enhance reproductive activities. The administration of gonadotropins, such as Human Chorionic Gonadotropin (HCG), can initiate spawning and the maturation of oocytes in fish. These hormone-mediated approaches have been widely applied to manage and regulate fish reproduction within both aquaculture and scientific research. Initially, extracts from fish pituitary glands were the primary means for stimulating reproduction; however, challenges associated with the preparation and proper preservation of pituitary extracts have led to the adoption of synthetic hormones, including LHRH-a, HCG, WOVA-FH, Ovatide, Synahorin, and Ovaprime, for induced breeding. LHRH-a alongside Domperidone is utilized to stimulate oocyte maturation and ovulation in bighead carp, Aristichthys nobilis. HCG serves to induce ovulation in fish, presenting three significant benefits: affordability, extended shelf life, and the availability of a purified form. WOVA-FH, a synthetic analogue of Gonadotropin-Releasing Hormone (SGnRH), has demonstrated efficacy in promoting induced breeding among Indian Major Carp, Exotic Carp, and Catfish. SGnRHs are frequently employed to manipulate reproductive functions in fish, and their effectiveness in inducing breeding represents a valuable asset in aquaculture and fisheries management. Ovatide is a locally sourced, cost-effective,

and highly efficient hormone for induced breeding in fish, with dosage requirements varying across different carp species. Synahorin, a synergistic formulation of CG and mammalian pituitary extract, has been effective in inducing spawning when used in conjunction with pituitary extract in both rohu and silver carp. Nevertheless, its sole administration to rohu was ineffective in stimulating spawning.Ovaprim is a novel analogue of gonadotropin hormone utilized in fish and serves as a replacement for pituitary gland extract. It is often regarded as superior to carp pituitary extract in inducing spawning across various carp species. Fertilization and hatch rates are typically elevated with Ovaprim treatment in comparison to pituitary treatments. Eggs subjected to Ovaprim treatment generally exhibit increased size post-water hardening, indicating greater egg development. The dosage needed for breeding female brood fish of diverse species is substantiated by various studies. For males, most species exhibit responsiveness within the range of 0.10 to 0.20 ml/kg. After spawning, the mortality rate of brooders treated with Ovaprim was minimal due to reduced handling compared to those treated with pituitary gland extract. Furthermore, Ovaprim can be maintained at room temperature without the necessity for refrigeration **(Sweety et al.2024).**

Role Of Kisspeptins And Pigments In Breeding:

Kisspeptins are neuropeptides that regulate the reproductive system of finfish through the hypothalamic-pituitary-gonadal (HPG) axis. They stimulate the release of Gonadotropin-releasing hormone (GnRH), which triggers the secretion of luteinizing hormone (LH) and follicle-stimulating hormone (FSH), essential for gonadal development. Kisspeptins also regulate the onset of puberty by activating reproductive hormone pathways, crucial for captive breeding. Exogenous administration of kisspeptins has been explored for spawning in commercial fish species.Pigments, especially carotenoids and melanin, impact fish breeding success by affecting coloration, mating, and reproductive health. Bright coloration signals health and genetic fitness, attracting mates and enhancing breeding success. Carotenoids improve egg quality by providing antioxidant protection, reducing stress levels, and regulating reproductive behavior through hormonal pathways. Healthy pigmentation also indicates better health and breeding potential.

Future Prospects in Finfish Genetics and Breeding Technology:

Finfish genetics and breeding are poised for significant advancements due to biotechnology, genomics, and sustainable aquaculture practices. These advancements aim to improve productivity, disease resistance, environmental adaptability, and overall sustainability in aquaculture systems. Key advancements include the integration of genomic selection (GS), which uses whole-genome data to predict and select fish with desirable traits, and CRISPR-Cas9 and genome editing, which allow precise gene modification to enhance traits like growth, disease resistance, and environmental tolerance.Multi-trait selection and genomic tools are also being developed, such as hybrid breeding, which combines growth, disease resistance, and environmental adaptability traits. Climate-resilient fish are being developed, allowing them to tolerate higher temperatures, salinity, and oxygen fluctuations due to climate change. Disease-resistant strains are being developed through genetic disease resistance and immunogenomics. Hybridization and polyploidy technologies are being explored for enhanced performance and sterility in fish production. Cryopreservation and germplasm banks are being used for genetic resource conservation, while surrogate broodstock technology is being used for species conservation. Artificial intelligence and big data are also being used in breeding, with AI and machine learning analyzing vast genetic and phenotypic data to optimize breeding strategies. Ethical and sustainable breeding practices are being prioritized, with a focus on non-GMO breeding strategies and natural trait enhancement.

Conclusion:

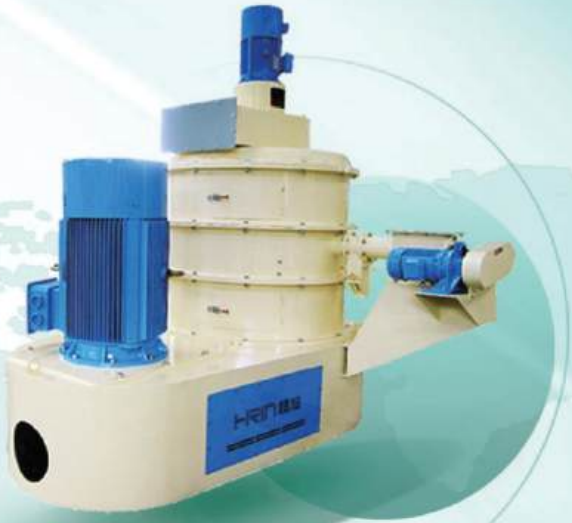
Progress in finfish genetics and breeding is revolutionizing aquaculture, making it a more sustainable, productive, and resilient sector. Cutting-edge technologies

such as genomic selection, CRISPR-mediated genome editing, hybridization, and reproductive biotechnology are expediting genetic enhancements in growth efficiency, disease resistance, and adaptability to environmental conditions. These methodologies not only improve production efficacy but also contribute to environmental preservation through approaches like the production of sterile fish and genetic containment. Nonetheless, prevailing obstacles, including the management of genetic diversity, ethical dilemmas, and regulatory challenges, remain. The incorporation of artificial intelligence, big data analytics, and environmentally sustainable breeding practices presents encouraging solutions. Looking ahead, the responsible application of these genetic innovations, in conjunction with sustainable management, will be vital for addressing the increasing global demand for high-quality, safe, and environmentally sustainable seafood.

References:

- Anuraj, A., Ambarish, G. P., Suresh Babu, P. P., Ranjan, R., Rajesh, N., Tamilmani, G., & Santhosh, B. (2024). Breeding and culture of finfishes.
- Ozaki, A., Araki, K., Okamoto, H., Okauchi, M., Mushiake, K., Yoshida, K., … & Okamoto, N. (2012). Progress of DNA marker-assisted breeding in maricultured finfish. Bull Fisheries Res Agency, 35, 31-7.
- Roy, K. (2016). Rapid review on the use of new age induced breeding agent 'LHRHa'in Indian finfish seed production sector. Journal of Fisheries, 4(2), 401-407.
- Rahman, M. A., Lee, S. G., Yusoff, F. M., & Rafiquzzaman, S. M. (2018). Hybridization and its application in aquaculture. Sex control in aquaculture, 163-178.
- Futuristic Trends in Agriculture Engineering & Food Sciences e-ISBN: 978-93-5747-388-0 IIP Series, Volume 3, Book 18, Part 1, Chapter 2 INDUCED BREEDING IN FISHES: AN OVERVIEW
- Kashyap, Narsingh, Prem Kumar Meher, Suresh Eswaran, Ayyathurai Kathirvelpandian, Uday Kumar Udit, Jaiswar Rahul Ramasre, Anand Vaishnav, Sanjay Chandravanshi, Domendra Dhruve, and Jham Lal. 2024. "A Review on Genetic Improvement in Aquaculture through Selective Breeding". Journal of Advances in Biology & Biotechnology 27 (7):618-31.
- Gopakumar, G. (2015). Recent advances in breeding and seed production of marine finfish. Convener, 5th International Symposium on Cage Aquaculture in Asia (CAA5).
- Liu, J. et al. 2024. Harnessing Hue: Advances and Applications of Fish Skin Pigmentation Genetics in Aquaculture. Fishes 2024, 9(6), 220)

Professional Feed Machinery Manufacturer



Hengrun SWFL Series Vertical Pulverizer

Vertical shaft with no-screen grinding, Bearing no maintenance. The production is uniform and the fineness is adjustable (Range from 40~200 mesh.)

Hengrun HRYTZ Series Vacuum Sprayer

Totally enclosed spraying space, Precision & Efficient spraying proportion widely ranged from 2%~30%.

Date of Publishing:
7 February 2025

RNI Regn. No.: 52899/93
Postal Regn. No.: HD/1068/2024-2026

Date of Posting:
8th, 9th February 2025

Invitation

41st Edition from NRS Group

India International Aquaculture Expo 2025

IIAE

Exhibition & Conference on Aquaculture

17-18 -19 April 2025

HITEX Exhibition Center,
Madhapur, Izzat Nagar, Hyderabad, India

Exhibition and Conference on Aquaculture sector to Update knowledge and for Better Business Opportunities

UPDATE®

Knowledge on Aquaculture

A One Day Conference

Gain Knowledge on Latest Advancements in Aquaculture from Experts

AI Awards 2025

For Excellence & Contribution to Aquaculture Sector

Recognition to the Individuals & Organisations for the Excellence achieved and Contribution to Aquaculture Sector

For Stalls booking and information, please contact:

The Chief Executive, NRS Events, Aqua International
BG – 4, Venkataramana Apts.,11-4-634, A.C. Guards, Hyderabad, India.

M: 96666 89554, Tel: 040 - 2330 3989
E-mail: iiae.nrs@gmail.com
W: www.aquainternational.in

Entry* FREE *for Visitors into Exhibition

Organised By NRS EVENTS
Aqua International
English Monthly since 1993