English Monthly from Hyderabad, India

RNI Regn. No. 52899/93

Aqua International

Estd. 1993

Health • Nutrition • Management • Processing

February 2024

Annual Subscription: Rs 800 Foreign $ 100

Inside...

Aqua International

English Monthly Magazine
(Established in May 1993)

Volume 31 Number 10 February 2024

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

Centre plans Rs 576 crore worth Aquaculture Plan to make North Shrimp-output Hub..

Best management practices for shrimp farming are a standardized set of farming practices to ensure the environmental and financial sustainability of shrimp farming systems. It includes key points like: Pond preparation methods, Water quality, Removal of organic wastages from pond bottom, Fertilization of the pond, Biosecurity systems, Seed selection, Stocking methods, Feed management, Disease management and Harvest methods.

Dear Readers,

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

Its interesting to note that the politician and the Chief Minister of Telangana State Mr A. Revanth Reddy strongly felt the need of strengthening Telangana State Public Service Comission on the lines of reputed Union Public Service Commission. The people and the youth of the country are suffering and struggling due to ever increasing commodity prices, increasing unemployment and religious intolerance. The CM's decision is a welcome step and it will help the needy, hardworking and talented youth to get employment.

UPSC had 100 years history and reputation of issuing employment notifications and taking up recruitments in a time-bound and transparent manner. This kind of steps should be followed by other states too on the lines of reputed UPSC and provide employment to the people.

The Union Government is working on an aquaculture plan worth Rs 576 crore in four northern states to create a hub of farming shrimp for export and domestic consumption by utilizing land unsuitable for crops. Over the past year, officials and scientists from the department of fisheries and the Central Institute of Brackishwater Aquaculture tested thousands of hectares of saline wasteland unfit for crops in 25 districts of Uttar Pradesh, Rajasthan, Haryana and Punjab, marking out clusters where shrimp aquaculture could be productive.

Aqua Exchange, a Vijayawada-based aquaculture and fintech startup, has raised 6 million dollars (nearly Rs 50 crore) in Series A funding. This round of funding was led by Ocean 14 Capital with participation from existing investors including Endiya Partners and Accion Venture Labs. According to its representatives, the funding received by Aqua Exchange will be used to scale adoption of the company's full-stack business model, including farm automation, crop financing and harvest procurement. Another technology being developed by Aqua Exchange, which is currently in the final production phase, helps the farmers in feed management by doing away with the need of manual intervention. This intelligent feed managing device ensures that the feed is distributed evenly and timely, thus reducing the feed wastage.

Carbon emission per one kilogram of fish caught in India's marine fisheries is 17.7% less than the global average, a study has found according to India's statement on climate-resilient fisheries before the Food and Agriculture Organization. In terms of climate change, India falls in the medium-to-high category considering the overall impact by 2050. Presenting India's statement at the first session of the sub-committee on fisheries management under the committee on fisheries of the FAO, the Indian delegation led by fisheries ministry former joint secretary J. Balaji suggested that FAO may plan to schedule capacity building exercises in mitigating emissions of greenhouse gases in capture fisheries and aquaculture; spatial planning; cross-sectoral planning; adaptive fisheries management; strengthening resilience; safety at sea; rehabilitate ecosystems; and stronger farming structures.

Schedule M prescribes the Good Manufacturing Practices for pharmaceutical products and the revised Schedule M has been notified as rules to ensure that GMP is adhered to and requirements of premises, plant and equipment for pharmaceutical products are met. The GMP is the mandatory standard that builds and brings quality into a product by way of control of

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

materials, methods, machines, processes, personnel, facility / environment and so on GMP was first incorporated in Schedule M of the Drugs and Cosmetics Rules, 1945 in 1988 and was last amended in June 2005.

Aquaconnect, a startup with a platform that gives aquaculture operators access to farm advisory, farm inputs and post-harvest market linkage, has launched a programme which will help to promote innovation in aquaculture sector in Tamil Nadu. The Fish Tank aims to promote innovation in the Indian aquaculture sector by providing a unique platform for early-stage startups and college students to showcase their next-generation ideas to the world and scale for impact.

India for the first time in 59 years was appointed recently as the first vice-chairman of the UN Food and Agriculture Organization, Committee on Fisheries Sub-Committee on Fisheries Management. This comes at a time when numerous countries are calling out China's illegal, unreported, and unregulated fishing practices in international waters, often violating Exclusive Economic Zones of other states. Established in 1965, the COFI is an intergovernmental forum that addresses issues on international fishing and aquaculture, providing policy guidance on fisheries management, recognising global challenges, and promoting collective solutions to ensure the environmental, economic and social sustainability of the fishing industry.

Value added fish products or seafood - based products have commercial potential and importance, is in ready-to-eat form, attractive and convenient for consumers in both domestic and export markets, and is prepared after recovery of fish flesh (neatly-sliced fillet and minced meat) by mechanically removing all kinds of intramuscular spines (bones), skin, gills, viscera, fins, scales and head. With the changing requirements and habits of consumers, the need for an increased market supply of ready-to-cook and ready-to-serve food products have come to fore front. Demand for ready-to-eat fish products is increasing in India because of the much-discussed human health benefits associated with consumption of fish and fishery products.

In the Articles section – Pond preparation and management for Successful shrimp farming, *authored by* Dr Raghavendrudu, informed that Shrimp cultivation in brackish water is a long-established practice in coastal districts of Andhra Pradesh, Gujarat, Odisha, West Bengal and other states of India. The white leg shrimp (*L.vannamei*) is the most farmed species along with Black tiger shrimp (*P. monodon*). Aquaculture is an activity producing fish or shellfish mainly for human consumption. It is carried out in ponds, enclosures or in open water bodies and thus involves continuous interaction with the environment. Aquaculture can be a sustainable activity, if it is carried out in socially and environmentally responsible manner, by adopting good aquaculture practices. Pond management means balancing production (anabolism) and decomposition (catabolism) processes.

Another article titled ***Role of Biofertilizers in Aquaculture,*** *authored by* Mr Jayashri Mahadev Swamy, Mr Uday Kiran, Mr Binal Khalasi and Mr Ganapathi Naik. M, said that Biofertilizers are ready to use live formulates of such beneficial microorganisms which on application mobilises the availability of nutrients with its biological activity. It helps in building the microflora and maintains the soil health. It is equivocally stated that biofertilizers can be used in agriculture. Field studies show that about 30 kgs of nitrogen can be saved by making use of cyanobacterial biofertilizers. The modern aquaculture is focusing mainly on the stable supply of the synthetic chemicals called as fertilizers. Excessive dependence of these fertilizers leads to the adverse effects and affect the integrity of the ecosystem.

Article titled **Hepatopancreatic Parvovirus (HPV) Disease – An Emerging Viral Infection in Penaeid Shrimps,** *authored by* Ms Laishram Soniya Devi, Mr David Waikhom, Mr Maibam Malemngamba Meitei, informed that globally, seafood demand has increased rapidly in recent years, leading to a substantial expansion in aquaculture, especially in commercially produced species, namely penaeid prawns and shrimps. To overcome the market demand leads to increased production, resulting in increased disease issues, mainly those with infectious aetiologies. Viral pathogens have promoted considerable economic losses within penaeid shrimp culture. HPV or Penaeus monodon densovirus of penaeid shrimp is an emerging shrimp virus that makes a significant financial loss in the shrimp industry and aquaculture. It infects several penaeid shrimp species worldwide and is detected frequently with other viruses.

Another article titled ***INTEGRATED TAXONOMY – New dimension to explore the fish diversity,*** *authored by* Mr M. Kishore Kumar, Mr P. Ramesh, Mr G. Thayala Arjun, said that the term "integrative taxonomy" was coined by Dayrat (2005) to describe a comprehensive approach to naming species. DNA sequencing technologies, access to museum collections, information about phylogenetics and phylogeography, advances in evolutionary studies and computer tomography have revolutionized conventional taxonomy in such a way that conventional taxonomy could be supplemented and complemented with information generated from all the above approaches. Species delimitation and a scientific consensus on naming could be achieved now by using a combination of different methods along with traditional taxonomy tools and this is the objective of integrative taxonomy.

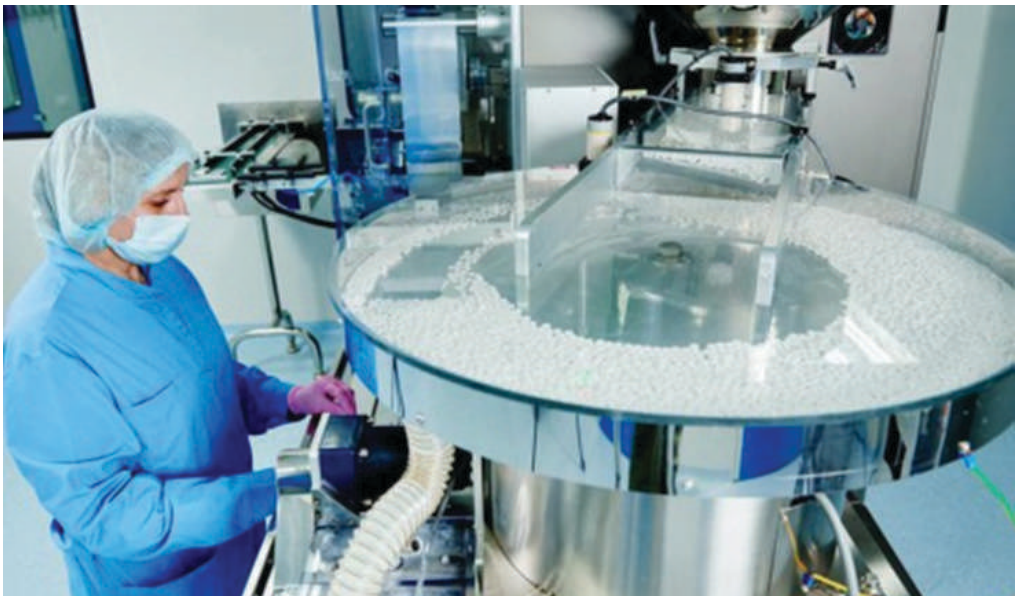
Article titled **Color Enhancement of Ornamental Fishes: Procedure and Suggestions to the Farmer,** *authored by* Mr Nayan Chouhan and Mr Bhavesh Choudhary, informed that Ornamental fishes, known for their vibrant colors and mesmerizing patterns, has become an integral part of multibillion global aquarium trade industry. These fishes are highly valued for their aesthetic appeal, and their brilliant colors are a significant factor in their popularity among hobbyists and collectors and have long captivated the hearts of aquarists and hobbyists around the world. Their vivid colors, graceful movements, and intricate patterns make them a centerpiece of many aquariums. While genetics play a crucial role in determining the natural coloration of these fishes, there are certain techniques and procedures that farmers can employ to enhance and maintain the vividness of these colors. The allure of these colorful aquatic creatures is undeniable, making them a highly sought-after commodity.

Results in Shrimp, Fish and Crab farming can be achieved as per specifications when the pond management guidelines are followed. Farmers and Integrators have to give sufficient time and attention to farm management and check the developments there to ensure results. When you invest your hard earned money into it, a little more care and attention can prevent losses and help in profitable farming all the time.

M.A.Nazeer
Editor & Publisher
Aqua International

Centre notifies revised rules for quality control of pharma products

The revised Schedule M prescribes the Good Manufacturing Practices (GMP) and requirements of premises, plant and equipment for the production of pharmaceutical product



GMP was first incorporated in Schedule M in 1988 and was last amended in June 2005

Aimed at ensuring robust quality control for pharma biopharmaceutical products, the Union Health Ministry on January 6, 2024 notified revised rules under Schedule M of the Drugs and Cosmetics Rules, 1945.

Schedule M prescribes the Good Manufacturing Practices (GMP) for pharmaceutical products and the revised Schedule M has been notified as rules to ensure that GMP is adhered to and requirements of premises, plant, and equipment for pharmaceutical products are met.

The GMP is the mandatory standard that builds and brings quality into a product by way of control of materials, methods, machines, processes, personnel, facility/ environment and so on

GMP was first incorporated in Schedule M of the Drugs and Cosmetics Rules, 1945 in 1988 and was last amended in June 2005.

With the amendment, the words 'Good Manufacturing Practices' (GMP) have been replaced with 'Good Manufacturing Practices and Requirements of Premises, Plant and Equipment for Pharmaceutical Products'.

Global benchmark

"To keep pace with fast changing manufacturing and quality domain, there was a necessity to revisit and revise the principles and concept of GMP mentioned in current Schedule M. This would bring our GMP recommendations on a par with global standards, especially to those of the World Health Organization (WHO), and ensure production of globally acceptable quality of drug." said a senior Health Ministry official.

The changes introduced in the revised Schedule M include the introduction of a pharmaceutical quality system (PQS), quality risk management (QRM), pro duct quality review (PQR), qualification and validation of equipment, and a computerised storage system for all drug products

The notification, dated December 28, 2023, states that manufacturers must assume responsibility for the quality of pharmaceutical products to ensure that they are fit for their intended use, comply with the requirements of the licence, and do not place patients at risk due to inadequate safety, quality, or efficacy.

It adds that companies must market a finished product only after getting "satisfactory results on tests of the ingredients and retain a sufficient quantity of the samples of intermediate and final products to allow repeated testing or verification of a batch.

Speaking about the revision, Sudarshan Jain, Secretary-General of the Indian Pharmaceutical Alliance (IPA), said: "The revision of Schedule M by the government is a positive step and an important milestone for the Indian pharmaceutical sector. This will elevate and update the quality standards of medicines, reinforcing the reputation of our industry and improving patient outcomes. We welcome this initiative in helping India's journey to become a global benchmark in quality."

Earlier in August, the Ministry had set a six month deadline for small manufacturers and a 12-month deadline for large ha units to get their World Health Organization-Good Manufacturing Practices (WHO-GMP) certification.

The revised rules are to be implemented based on company turnovers where the medium and small manufacturers include those with an annual turnover of less than 250 crore and large manufacturers include those with an annual turnover of over 1250 crore.

Courtesy: The Hindu, January 7, 2024

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

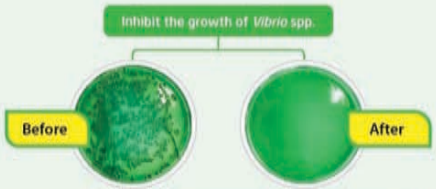
Prevent the accumulation of toxic substances such as NH_3, NO_2, etc.

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:

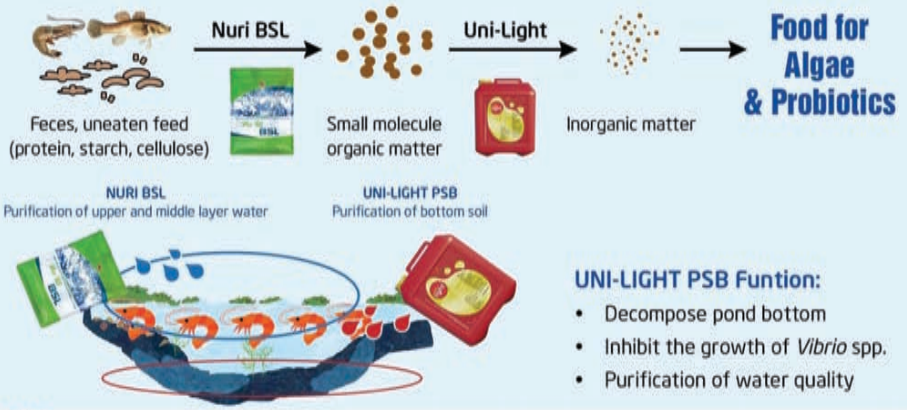
Bacillus spp. > 1x 10^{11} cfu/kg	15%
(Bacillus subtilis, Bacillus amyloliquefaciens, Bacillus licheniformis)	
Carrier (rice bran, corn gluten)	75%
Moisture	10%

* 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 m³ 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

Government committed to strengthen TSPSC on lines of UPSC, says CM

Telangana Chief Minister A. Revanth Reddy has said that his government has resolved to strengthen the Telangana State Public Service Commission on the lines of Union Public Service Commission (UPSC) which had 100-year history and reputation of issuing notifications and taking up recruitments in a time-bound and transparent manner.

The Chief Minister conveyed the government's intentions to UPSC Chairman Manoj Soni when he called on the latter in New Delhi recently. The discussions during the hour-long meeting centred on functioning of the UPSC and steps that should be taken to reform the TSPSC for meeting the aspirations of the unemployed youth.

Mr Revanth Reddy enquired about the functioning of the UPSC which was known for its transparent processes, without giving scope for allegations of corruption in its century-long existence. The Telangana government had decided to adopt new policies and processes for taking up recruitments, he said.

Dr Manoj Soni had appreciated the "young Chief Minister" for his decision to focus on the recruitment processes and told him that there would be no political interference in the selection of chairman and members of the UPSC. The selection would solely be based on the merit and efficiency of the candidates.

Telangana Chief Minister A. Revanth Reddy and Irrigation Minister N. Uttam Kumar Reddy called on UPSC Chairman Manoj Soni in New Delhi on January 5, 2024

The Chief Minister informed the UPSC Chairman that the Telangana government proposed to take up recruitment for two lakh vacant posts by the end of December 2024 and it was accordingly decided to reform the TSPSC. He told Dr Manoj Soni how the previous government had politicised the appointments to the TSPSC and converted the Commission into a "political rehabilitation centre".

As a result, issuance of notifications, conduct of examinations and declaration of results had become a ritual while leakage of question papers had become a major issue during the BRS tenure.

Mr Revanth Reddy had averred that the State government was committed to take up appointments of chairman and members of the TSPSC without giving scope for political interference and it was resolved to appoint them on a permanent basis.

Responding to the Chief Minister's request, the UPSC Chairman had assured that training would be provided to the chairman and members of the TSPSC and awareness programmes would be conducted for staff in the Secretariat in this direction.

The Chief Minister's decision is a welcome and it will help the hardworking and talented youth to get employment in Telangana state.

This kind of steps should be followed by other states and provide employment in a transparent manner.

The Chief Minister's decision is a welcome step and it will help the needy, hardworking and talented youth to get employment in the state.

This kind of steps should be followed by other states on the lines of the reputed UPSC and provide employment in a time-bond and transparent manner.

- Editor

Aquaconnect and StartupTN launch blue economy innovation challenge in Tamil Nadu

Aquaconnect, a startup with a platform that gives aquaculture operators access to farm advisory, farm inputs and post-harvest market linkage, has launched a programme which will help to promote innovation in the aquaculture sector in Tamil Nadu.

Sivarajah Ramanathan, mission director and CEO of StartupTN (left) and Rajamanohar Somasundaram, founder and CEO, Aquaconnect, with copies of the MoU

As part of the deal, Aquaconnect signed a memorandum of understanding (MoU) with StartupTN in a bid to foster innovation and support the growth of startups in the aquaculture sector in the state. Backed by the Tamil Nadu government and Sathyabama University the agreement also marks the launch of The Fish Tank-India's Grand Aquaculture Innovation Challenge.

The Fish Tank aims to promote innovation in the Indian aquaculture sector by providing a unique platform for early-stage startups and college students to showcase their next-generation ideas to the world and scale for impact. The programme will cover broader aspects of the aquaculture value chain, both pre- and post-harvest, wherein applicants can propose ideas related to affordable IoT/ software-based solutions to monitor water quality, daily feeding, animal health, biotechnological advancements to improve production efficiency, seafood processing, preservation and value addition, amongst others.

The top ten candidates will have an opportunity to participate in the incubation programme at Sathyabama TBI, with access to resources and mentorship support while also gaining access to StartupTN's blue economy network, which encompasses fisheries research and development institutes, academic institutions, and their facilities across the state.

In addition to this, two winners will be selected and awarded with a cash prize of 1 Lakh (100,000 rupees) each and an opportunity to work with Aquaconnect to launch and scale their solution in the market.

Sivarajah Ramanathan, mission director and CEO of StartupTN, said in a press release: "StartupTN's blue economy forum is first of its kind professional network to promote collaborative efforts between government initiatives, academia, and industry players which will drive a transformative growth, for making Tamil Nadu a hub for seafood-focused startups. I invite all aspiring entrepreneurs, early-stage startups to solve the challenges of Fish Tank and contribute to the blue economy of the state."

Rajamanohar Somasundaram, founder and CEO, Aquaconnect added: "The collaboration with StartupTN underscores our commitment to accelerating blue economy initiatives in Tamil Nadu. We are excited to witness how this will unfold and impact the sector on a large scale. Being the second largest producer globally, India's aquaculture sector holds enormous potential, and it needs wider participation from forward-thinking individuals. I believe FishTank will be a pivotal step in fostering young entrepreneurship and unlocking the doors for incredible talent in Tamil Nadu."

Team Agrotech

YOUR STEPPING STONES IN SUCCESS!!

Country Representative
CPM ASIA

Your Single Stop Source for

Complete Project management of Turnkey Solutions in the following areas:

1. Integrated Feed plants for Poultry, Floating Fish, Sinking Fish, Shrimps, Cattle etc.
2. Balance of plant eqpuipments for Pre/Post processing
3. Complete Plant Automation Solution, on **GATE In to GATE Out concept.**
4. In-house design and manufacturing of Pre Fabricated steel structures for Plants, Warehouses etc.

CPM Dryer

CPM Pellet Mill

CPM Extruder

Contact Today

Team Agrotech Pvt. Ltd.

1- 4, 249, Hill Road, Gandhi Nagar, Nagpur-10 , Maharashtra, India.
M. : +91 9422803386, +91 9650559095
Ph. : +91 712 2222142
e-mail : teamagrotech@yahoo.com
Website : www.teamagrotech.com

For Queries Contact

Scan me

India elected vice-chair of UN fisheries body amid countries calling out China's illegal fishing

Established in 1965, FAO Committee on Fisheries addresses ***issues on international fishing and aquaculture, providing policy*** *guidance among others.*

New Delhi: For the first time in 59 years, India was appointed recently as the first vice-chair of the UN Food and Agriculture Organization (FAO) Committee on Fisheries (COFI) Sub-Committee on Fisheries Management.

This comes at a time when numerous countries are calling out China's illegal, unreported, and unregulated fishing practices in international waters, often violating Exclusive Economic Zones (EEZs) of other states.

Between 2019 and 2021, China fished in EEZs of over 80 other countries for more than 3 million hours and spent nearly 10 million hours outside its own EEZ in the high-seas and the EEZs of other nations, according to a report.

Established in 1965, the COFI is an intergovernmental forum that addresses issues on international fishing and aquaculture, providing policy guidance on fisheries management, recognising global challenges, and promoting collective solutions to ensure the environmental, economic and social sustainability of the fishing industry.

The grouping also makes recommendations to the FAO Council or its Director-General. The Sub-Committee on Fisheries Management is a new sub-group formed under the COFI in 2022, during the 35th session of the FAO Committee on Fisheries (COFI), held in Rome. It will work closely with the two other COFI sub-committees, the Sub-Committee on Aquaculture and the Sub-Committee on Fish Trade.

India is one of the top fishing nations with over 28 million inland and marine fisheries. It is also one of the founding members of the FAO, whose headquarters is in Rome.

India's embassy in Italy, which revealed the development on social media platform X, formerly Twitter, observed that the country's inclusion as a member of the committee "would give much-needed balance & perspective to the global narratives concerning fisheries governance & management (especially for artisanal & small-scale fisheries)".

At the opening of the meeting's virtual plenary session this week, FAO director-general QU Dongyu said, 'Improving global fisheries management remains crucial to restore ecosystems to a healthy and productive state and to protect the long-term supply of aquatic foods."

"This improvement also includes eliminating illegal, unreported, and unregulated fishing and on addressing the impacts of the climate crisis, and biodiversity degradation that are also heavily impacting aquatic and coastal ecosystems and dependent communities," he added.

A Concept on Commercially-important Value-Added Fish and Shrimp-based Edible Products

Value-added fish products or seafood-based products have commercial potential and importance, is in ready-to-eat form, attractive and convenient for consumers in both domestic and export markets, and is prepared after recovery of fish flesh (neatly-sliced fillet and minced meat) by mechanically removing all kinds of intramuscular spines (bones), skin, gills, viscera, fins, scales and head. With the changing requirements and habits of consumers, the need for an increased market supply of ready-to-cook and ready-to-serve food products have come to fore front. Demand for ready-to-eat fish products is increasing in India because of the much-discussed human health benefits associated with consumption of fish and fishery products.

Fish pickle

Small marine fishes like *Nemipterus japonicus*, sciaenid fishes are used. Ingredients include fish (dressed and cut into small pieces), mustard, green chilli, peeled garlic, peeled and chopped ginger, chilli powder, turmeric powder, sesame oil, 1.5% acetic acid, salt, powdered pepper, cardamom, clove and cinnamon. Flexible laminated pouches made of 12 micron polyester used for packing the pickle. Technology developed by ICAR-Central Institute of Fisheries Technology, Kochi.

Prawn pickle

Ingredients include peeled prawn, green chilli, ginger, garlic, chilli powder, turmeric powder, sesame oil, boiled and cooled 1.5% acetic acid, salt and sugar. Addition of proper quantity of salt, spices and preservatives increase taste and shelf life of prawn pickle. Shelf life of small-sized marine prawn/shrimp and small fishes can be increased by pickling process. Technology developed by ICAR-CIFT, Kochi.

In another technology of prawn pickle of ICAR-Central Institute of Fisheries Education Kolkata Centre, ingredients include peeled prawns *Metapenaeus affinis*, *Parapenaeopsis stylifera*, mustard seed, methi seed, peeled garlic, fresh ginger, green chilli, chilli powder, cumin powder, salt, sugar, double refined oil, vinegar, benzoic acid. Product remains acceptable at ambient temperature for 6 months. Prawn chutney powder is made from sun-dried prawns/shrimps, black gram, coconut, curry leaves and other spices.

Fish soup powder

It is rich in essential dietary nutrients. Threadfin bream and other marine fishes of less demand and economic value landed in marine fish landing centres, are used. It is not economic to preserve these fishes, original fishes would have been unacceptable as whole fish. Ingredients include picked cooked meat/processed fish meat, salt, fat, onion, coriander, starch, milk powder, sugar, pepper powder, ascorbic acid, monosodium glutamate. Every five gram of fish soup powder to be boiled for 5mins in 100ml water before eating. Technology developed by ICAR-CIFT, Kochi.

Fish wafer or Fish tikiya

Dried, ready-to-fry and serve product. Ingredients include processed fish meat (to be homogenized in water in mechanical grinder), corn flour, tapioca starch, common salt, water. Dried product packedin sealed polythene bags, consumed after frying in oil. Technology developed by ICAR-CIFT, Kochi.

Fish cutlet

Fish keema is the basic raw material; other ingredients include cooked fish meat in boiling water, salt, oil, green chilli, ginger, onion, cooked potato, powdered pepper and clove, turmeric, eggs, bread powder. Product is stored at -20°C in deep freezer, thawed and fried in oil before use, oval or round in shape. Technology developed by ICAR-CIFT, Kochi.

In another technology developed by College of Fisheries, Lembucherra, Agartala, Tripura, ingredients of fish cutlet include fish meat, potato, ginger, garlic, green chilli, onion, turmeric and chilli powder, cumin and coriander powder, sugar, garam masala, clove and pepper powder, baking powder, besan, rice powder, bread crumbs, refined oil, salt. Initially the fish meat free of spines (bones) is chopped into very small size. Ultimately, breaded fish cutlets packed in polythene bags, stored in -20°C, remains well for 3 months.

Ready-to-serve fish curry in flexible pouches

Marine fish curry is a ready-to-consume form of curry processed in metal cans (containers). Oil sardine, mackerel, herring, seerfish, tuna are used to prepare such curry. Technology developed by ICAR-CIFT, Kochi.

Fish finger

Fish fingers are regular-sized portions cut from rectangular frozen blocks of boneless fish flesh; prepared from fillets and fish mince. They are normally coated with batter, and then with dried bread crumbs before being flash fried (at 180-200°C for 40-60sec), and frozen at -40°C. Ratio of water:dry batter = 1.8:1. Wild and farmed shrimps may be used, in addition to fishes. Technology developed by ICAR-CIFT, Kochi.

Breaded and battered products

Value addition of fish meat and prawn meat can be done by breading and battering, it gives coated products. With coating of another edible product {first batter (wheat flour, gram flour with flavour

enhancers) and then bread crumbs, small fragments of dried bread}, it adds to the bulk volume, brings down the cost of production. Frozen blocks of fish fillets, minced fish and shrimp meat are used for breading and battering in battering machine.

During battering, thin layer of ice can be there on raw material, batter cannot get adhered. So pre-dust material (starch, corn flour) used which helps the batter to coat the material. Shrimps or fish fillets are washed, water removed, dried, pulverized and cooked with onion, potato, spices. After that, it is moulded to form cakes for breading and battering. For low viscous batter, 'pour on' process applied with overflowing batter. For high viscous (sticky, semi-fluid state) batter, the material dipped and submerged in batter when it passes through a conveyor belt. Excess batter on material removed before going to breading machine. Bigger size bread crumbs gives good colour & appearance. Pressure rollers fix bread crumbs uniformly on the battered product (batter coated portions). Meat content of product should not be less than 50%.

Coating thickness is increased by increasing viscosity (stickiness) of the batter. After breading, the breaded and battered product is passed through oil bath at 200°C, contact time 12-20secs. This is called 'pre-frying' or 'flash frying'. A golden-brown colouration now develops on product and crust formed, which prevents loss of water from fish content to outside. Now cool air is blown over the product, after that it goes for freezing and cold storage at -40°C. After packing in thermoform (heated sheets of plastics forming cavity) containers and master cartons, product is stored at -20°C. Product is fried for about 4-12mins at 105°C before consumption. The sciaenid fishes *Johnius* sp, *Otolithes* sp and Bhetki *Lates calcarifer* are preferred for making fillets.

Some examples of breaded and battered products are fish fingers, fish balls, fish burgers, fish cutlets - all prepared out of minced fish. Batter contains 2000gm Maida, 200gm corn flour, 200gm chholar besan, 30gm common salt, 5gm turmeric powder, 5gm Sodium triphosphate as preservative. Technology developed by ICAR-CIFT, Kochi.

Ready-to-serve restaurant-grade products from freshwater fishes like *Pangasius* sp (Pangas catfish), Silver carp, grass carp

These fishes are utilized (not high priced) for preparation of different value-added ready-to-serve fish products for sale in restaurants. It ensures low to medium investment and high returns. Technology developed by College of Fisheries, Lembucherra, Agartala. Fish munch, the ready-to-eat fish meat fortified snack has been developed by ICAR-CIFE, Mumbai.

Fish momo

It is steamed dumpling filled with fish meat and other ingredients; dumpling is made from starch sources wrapped around the fish filling. Ingredients include fish meat, ginger, green chilli, Maida, onion, garlic, salt; it is served hot. Technology developed by College of Fisheries, Lembucherra, Agartala and ICAR-CIFT, Kochi.

Fish sandwich

Ingredients include fish meat, ginger, garlic, green chilli, powdered chilli, cumin and turmeric, fenugreek, salt, sugar, garam masala, refined oil, butter, sandwich bread, tomato sauce. A fine paste is made out of cooked fish meat, 12-15gm of which required for each sandwich. Fishes used as raw material are *Nemipterus japonicus*, sciaenid fishes, *Johnius* sp, *Nibea maculata*, *Sciaena* sp, *Otolithes* sp. Technology developed by College of Fisheries, Lembucherra, Agartala. ICAR-CIFE, Mumbai has developed ready-to-eat fish sandwich spread in retort pouches using low-cost fish mince.

Fish samosa

It is a dish with salty and spicy filling, containing dressed and cooked minced fish, cooked potatoes, chopped onions, green peas and other ingredients. Fried in sufficient quantity of oil before eating. Technology developed by ICAR-CIFT, Kochi.

In addition to other conventional fish-based food products, the BENFISH (Dept of Fisheries, Govt of West Bengal) has introduced new dishes like prawn cutlet, lemon fish fry and Topse (*Polynemus* sp) maachher fry. BENFISH have shops in different places in Kolkata and sells fish-based ready-to-eat very tasty preparations on BENFISH trucks, such as fish fry, fish cutlet, fish butter fry, fish finger, battered fish fry. At Department of Fish Processing Technology, Faculty of Fishery Sciences, West Bengal University of Animal and Fishery Sciences, Kolkata, extruded fishery products have been prepared from minced meat of locally-available low-valued fishes. Fish soup powder prepared using extracted shrimp flavour. Fish/shrimp 'papad' prepared from low-valued fish/shrimp; ingredients include black gram flour or Urad dal, fish meat, salt, Sodium bicarbonate and Sodium carbonate, ginger, garlic. Development of fish snacks have been made possible using dry surimi powder, which is tasteless and odourless concentrated myofibrillar protein extracted from paste made from minced meat of the fish *Tilapia nilotica*. Surimi powder may be used for making friable food products.

Founder Director of ICAR-CIFT, Kochi and eminent food technologist from Kolkata Prof. A. N. Bose died twenty years back in 2003. Also Dr K. K. Balachandran, Retd. Principal Scientist, ICAR-CIFT took my classes in MSc on value-added fish products during 2002-2003. I dedicate this short article to them.

Subrato Ghosh

Centre plans to make north shrimp-output hub

India is currently the second-largest aquaculture shrimp producer at 900,000 tonne in 2022, after Ecuador

The Union government is working on an aquaculture plan worth ₹576 crore in four northern states to create a hub of farming shrimp for export and domestic consumption by utilizing land unsuitable for crops, two officials with the knowledge of the matter said.

Over the past year, officials and scientists from the department of fisheries and the Central Institute of Brackishwater Aquaculture tested thousands of hectares of saline wasteland unfit for crops in 25 districts of Uttar Pradesh, Rajasthan, Haryana and Punjab, marking out clusters where shrimp aquaculture could be productive, one of the persons said, seeking anonymity.

The scientists found that productivity of the farmed crustaceans or output per hectare is roughly the same in Haryana as the world average at about 6-7 tonne, making it potentially a major centre for shrimp farming. Most shrimp is farmed in the country's coastal states.

In India, shrimp farming has been supported by the World Bank, Food and Agriculture Organization and Asian Development Bank and the country is one of the biggest exporters of cultured shrimp. Indian seafood sector is gearing up for accelerated growth with both houses of Parliament passing the Coastal Aquaculture Authority (Amendment) Bill 2023, according to industry reports. The country is currently the second-largest aquaculture shrimp producer at 900000 tonne in 2022, after Ecuador.

Globally, shrimp farming is freshwater guzzling, run by large companies and seen as ecologically damaging. The highly automated shrimp industry often doesn't prioritize local employment and tends relocate in the face of tough regulations. Ecological activists call it the "hamburger connection" in which central American rainforests are razed to culture shrimps that end up in burgers.

"The difference with the shrimp hubs in these states will that they will be eco-friendly, using technologies such as biofloc and will come up only on unproductive wasteland," said Sagar Mehra, joint secretary in the fisheries department.

The shrimp clusters are aimed at generating 50,000 local jobs, from direct employment to those around ancillary warehousing and cold storages. A modern aqua park in Bhiwani built with a funding of ₹100 crore will serve as a training centre, a second official said, declining to be named.

Each kilogram of shrimp farmed generates about 15,000 litres of effluent, often with toxic residues. This stew is often released untreated into the groundwater, contaminating the drinking water of local communities.

The shrimp hubs in northern India will utilize biofloc developed by the Central Institute of Brackishwater Aquaculture, which will treat excreta and other wastes on site and convert them into feed for the crustaceans.

The Pradhan Mantri Mudra Yojana – where funding is shared on a 60:40 basis between the Centre and states -- aims to create aquaculture assets enough to generate 5.5 million livelihoods nationally till 2025. Funds will be made available to new shrimp farmers through this micro-credit scheme.

The districts chosen for the project include Rohtak, Fatehabad and Gurugram in Haryana, besides Mathura, Agra and Hathras in Uttar Pradesh. They also include Fazilka, Muktsar and Mansa in Punjab; and Ganganagar and Churu in Rajasthan.

"The key to this project's success will be to ensure there is handholding from start to finish and export avenues and remunerative prices are ensured through market linkages," said CV Balakrishna, a former marine consultant with the FAO. For exports, agreements are expected to be signed with Marine Products Export Development Authority, the first official said.

18% less carbon emitted per kg of fish caught by India

Kochi: Carbon emission per one kilogram of fish caught in India's marine fisheries is 17.7% less than the global average, a study has found according to India's statement on climate-resilient fisheries before the Food and Agriculture Organization (FAO). In terms of climate change, India falls in the medium-to-high category considering the overall impact by 2050.

Presenting India's statement at the first session of the sub-committee on fisheries management under the committee on fisheries (COFI) of the FAO, the Indian delegation led by fisheries ministry former joint secretary J Balaji suggested that FAO may plan to schedule capacity building exercises in mitigating emissions of greenhouse gases in capture fisheries and aquaculture; spatial planning; cross-sectoral planning; adaptive fisheries management; strengthening resilience; safety at sea; rehabilitate ecosystems; and stronger farming structures.

A delegation from the Central Marine Fisheries Research Institute (CMFRI) was part of the Indian team at the session, which was organised virtually from FAO, Rome.

"A big step towards climate resilient fisheries is harnessing the carbon sequestration potential of seaweeds to mitigate climate change impacts. Enhancing natural habitats for improving seaweed resources and expanding seaweed culture systems and enhancing mangrove ecosystems may help lay the path for better carbon sequestration", India's statement said.

Principal scientist and head of fishery resources assessment, economics and extension division of CMFRI J Jayashankar presented the statement and highlighted India's proactive stance on tackling the climate crisis in the fisheries sector.

Finfish fisheries division head Shoba Joe Kizhakudan said promoting more marine protected areas to match the requirements of the sustainable development goals and the initiatives like artificial reefs at suitable locations along the coastal stretch of the country add to India's efforts to bring biodiversity to centre stage by keeping livelihoods of traditional fishermen unaffected.

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

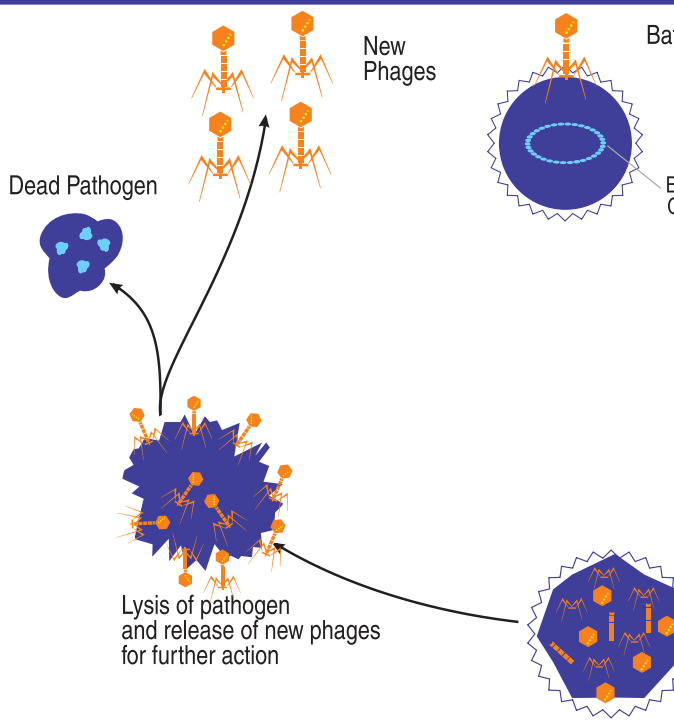
V PHAGES HATCHERY & V PHAGES GROWOUT are a c
they are safe on aquatic animals, people and ecosystem
resistant to antibiotics and incr

"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 PHA



www.salemmicrobes.com

To order contact

+91 93448 37525

E-Mail : contact@salemmicrobes.com

A Product of

SALEM MICROBE

An ISO 9001 : 2015 Company

IOPHAGE
O DESTROY
IC VIBRIOS

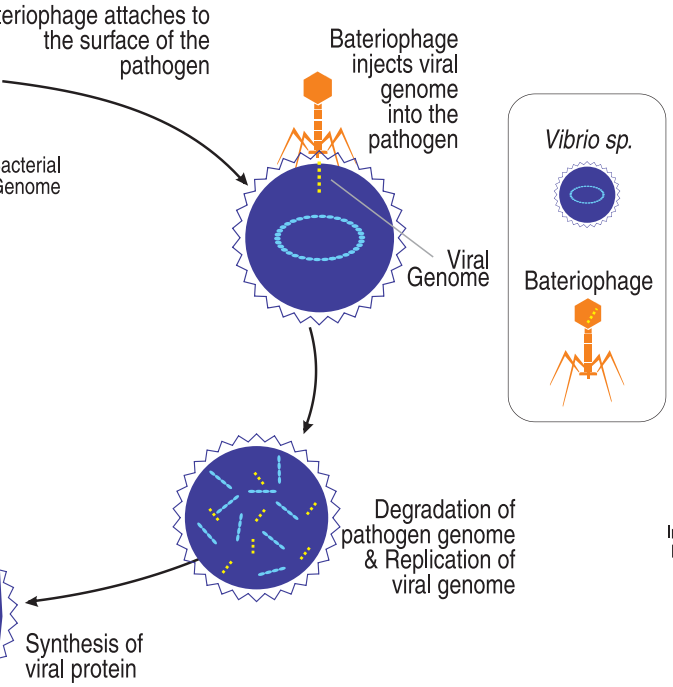
ocktail of Phages isolated from Natural environment. Hence
ns. This destroys the pathogenic bacteria which are even
eases the efficacy of probiotics.

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

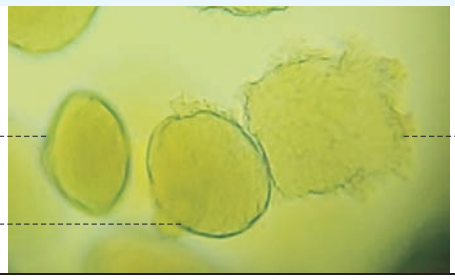
CAA Certified Antibiotic-free Product
CAA/MAR2023/PRO/04631

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

Vijayawada aquaculture startup raises ₹50 cr in series A funding

Visakhapatnam: AquaExchange, a Vijayawada - based aquaculture and fintech startup, has raised $6 million (nearly Rs 50 crore) in Series A funding. This round of funding was led by Ocean 14 Capital with participation from existing investors including Endiya Partners and Accion Venture Labs.

According to its representatives, the funding received by AquaExchange will be

used to scale adoption of the company's full-stack business model, including farm automation, crop financing, and harvest procurement.

The company also plans to focus their efforts on a few international markets for device exports. The startup raised $3 million back in June 2022.

AquaExchange's patented technology product called PowerMon continuously monitors the power consumption of the aquafarms based on machine learning techniques. With this device, the farmers can monitor the aerators, oxygen levels, and other operational issues in these ponds from their mobile phones itself.

Another technology being developed by AquaExchange, which is currently in the final production phase, helps the farmers in feed management by doing away with the need of manual intervention. This intelligent feed managing device ensures that the feed is distributed evenly and timely, thus reducing the feed wastage.

AquaExchange founder Pavan Kosaraju said that they are committed to transforming aquaculture through technology.

US food quality experts in Kochi to impart quality training

The four-day training programme has been organised in collaboration with the Central Institute of Fisheries Technology (CIFT), aiming to elevate the quality of seafood exports to meet the USFDA standards.

KOCHI : A team of experts from the US Food and Drug Administration (FDA) and the US Joint Institute for Food Safety and Applied Nutrition (JIFSAN) have landed in Kochi to impart training to seafood industry professionals to detect the quality of seafood and avoid the export of decomposed products to the US.

"We have regulations in the US to ensure the quality of seafood reaching the consumers. The training programme is aimed at standardising the procedure to detect the quality of shrimp by checking the

odour. Because, if the consignment does not pass the quality test in the US, it will be returned," JIFSAN aquaculture and seafood safety expert Brett Koonse told TNIE.

"We are imparting training to industry professionals, government officials and representatives of academia, which will help them identify the level of decomposition of seafood. You should be able to identify the level of decomposition on a 1-100 scale. So if the rating is below 50, the consignment is good and anything above 50 is bad," he said.

The four-day training programme has been organised in collaboration with the Central Institute of Fisheries Technology (CIFT), aiming to elevate the quality of seafood exports to meet the USFDA standards.

"It aims to equip regulatory and seafood industry professionals with crucial insights into sensory analysis which is a pivotal tool for ensuring the quality and safety of seafood. The primary focus of the course is on detecting and preventing seafood adulteration resulting from decomposition to safeguard consumers from potential health risks and also to reduce the exports of faulty consignments," said CIFT director George Ninan.

"This initiative is part of the USFDA's commitment to fostering a positive outlook in the Indian seafood export industry by conducting a series of training sessions for seafood exporters and regulatory officials," said USFDA India country director Dr Sarah McMullen.

North India Stakeholders Urge for Lower Seed & Feed rates

Industry requests Government to include Shrimp in Defence Menu; MP & BMR Group CMD B. Masthan Rao assures to reduce Shrimp Seed Price

Aqua International organises 39th Aquaculture Expo at Hisar, Haryana

Hisar, Haryana: Mr B. Masthan Rao, Member of Parliament (Rajya Sabha), Member – Consultative Committee for the Ministry of Commerce and Industry, Govt of India and Chairman, BMR Industries Ltd addressing the inaugural session as the chief guest of Aquaculture Expo 2024 at Hisar said that requests and proposals are given to the Union Government to include Shrimp in Defence Department.

Replying to the request made by the speakers from northern region, B. Masthan Rao assured to reduce shrimp seed price.

Not only in India through out the globe there are problems in Aquaculture. Indonesia and Ecuador are facing issues of diseases to shrimps due to higher stocking density and production will come down in these two countries which will help the Indian farmer to get better price. After June, July 2024 better prices are expected to Indian shrimps he stated.

B. Masthan Rao, Member of Parliament (Rajya Sabha) inaugurating 39th edition of Aquaculture Expo 2024 at Hisar on 20 January 2024

The formation of separate ministry for fisheries at Union Government with an allotment of INR 20,000 crore for fisheries sector has given confidence for the growth of aquaculture sector in India, he stated.

Aquaculture industry made me to grow to the present position. I will do my best to supply quality seed and other inputs. To have successful crop 60% depends on quality seeds, 20% on quality feed and inputs and the balance 20% depends on good management practices, said Masthan Rao. He also assured to help in shrimp purchase from northern region of the country. He informed that the Andhra Pradesh government is working to setup 2000 shrimp and fish outlets to promote the consumption of these products.

Mr Ravinder Singh, Managing Partner, Haryana Aqua Food; Mr Rajkumar Sharma, Proprietor, Sharma Feed Supplements Trading Coy); Mr Vinod Poonia, Proprietor, Dr Attar Aqua Feed & Frozen Foods and Mr Rajveer Singh, Proprietor, Gurunanak Trading Coy appealed to the hatcheries and feed companies to reduce the prices of seed and feed. They also spoke on the difficulties the shrimp farmers in northern region facing to sell their harvester shrimps and to get remmunidative price to shrimp raw material.

Ms Anita Dahiya, Deputy Director of Fishery, Hisar, Haryana and Mr Jagdish Chander, DFO, Sirsa district also participated.

In his welcome speech, M.A. Nazeer, Convener, Aquaculture Expo 2024 said that shrimp farming is growing in the states of Haryana, Rajasthan and Punjab, but without cold storage facilities and shrimp processing facilities farmers are struggling a lot to sell their produce – shrimps – and the shrimps at a profitable price. Farmers need help for better price, then only the industry will grow in northern region.

A view of participants in the inaugural session of Aquaculture Expo 2024 at Hisar

B. Masthan Rao lighting the lamp to mark inauguration of 39th Aquaculture Expo 2024 as Ms Anita Dahiya, Vinod Poonia, Ravinder Singh and M.A. Nazeer look on at Hisar, Haryana on 20 January 2024.

M.A. Nazeer, Convener, Aquaculture Expo 2024 giving welcome speech during 39th edition Aquaculture Expo 2024 at Hisar on January 20. Chief guest B. Masthan Rao, Vinod Poonia, Anita Dahiya, Ravinder Singh, Rajveer Singh, Rajkumar Sharma are on dias.

B. Masthan Rao,
Member of Parliament (Rajya Sabha), Member – Consultative Committee for the Ministry of Commerce and Industry, Govt of India and Chairman – BMR Industries Ltd.

Ravinder Singh,
Managing Partner, Haryana Aqua Food.

Rajkumar Sharma,
Proprietor, Sharma Feed Supplements Trading Coy.

Rajveer Singh,
Proprietor, Gurunanak Trading Coy

Vinod Poonia, *Proprietor, Dr Attar Aqua Feed & Frozen Foods*

About 90 % of the shrimps produced in India are exported, but some of the consignments are rejected every now and then. Hence, it is important to safeguard the freshness of harvested shrimps before processing and exporting to overseas.

We need to give focus on developing domestic consumption and domestic market. Like China, India has huge potential for the consumption of shrimps.

Dealers are playing important role in Aquaculture in northern region of the country and they are the bridge between the farmers and the industry. I request them to help farmers in getting better yield and profitable price to their shrimps. If farmers get profits, the industry will survive and grow well in this region. Farmers should give personal attention in the day to day activities of shrimp farming and get better.

Experts – Farmers Interaction Meet:

An interaction meet session between the experts and the farmers was organized in a launge in the exhibition hall and some farmers utilised the opportunity and interacted with experts and got clarifications and solutions for different problems in the culture. results, said M.A. Nazeer.

Jagdish Chander,
DFO, Sirsa district

Experts – Farmers Interaction Meet

M.A. Nazeer presenting momento to Nitin Pipralia and Ashutosh Lowanshi

A view of Aquaculture Expo 2024 held at Hisar, Haryana on January 20 & 21, 2024

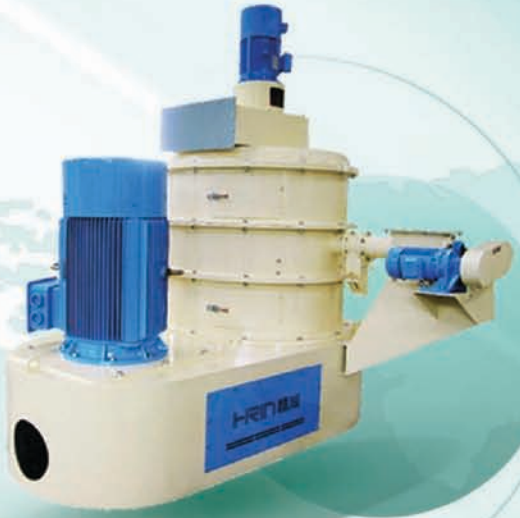
39th Edition Aquaculture Expo 2024
Exhibition & Conference on Aquaculture Sector

Expo Convener and Editor, Aqua International, M.A. Nazeer presenting Mementos to Exhibitors at AE 2024 in Hisar, Haryana on 21 January 2024




VIPs and others with Chief Guest Member of Parliament (Rajya Sabha) B. Masthan Rao for a photograph after the inaugural session.

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%.

Pond preparation and management for Successful shrimp farming

Dr Raghavendrudu, Product Manager, Skretting India

Shrimp cultivation in brackish water is a long-established practice in coastal districts of Andhra Pradesh, Gujarat, Odisha, W.Bengal and other states of India. The white leg shrimp (*L. vannamei*) is the most farmed species along with Black tiger shrimp (*P. monodon*). Aquaculture is an activity producing fish or shellfish mainly for human consumption. It is carried out in ponds, enclosures or in open water bodies and thus involves continuous interaction with the environment. Aquaculture can be a sustainable activity, if it is carried out in socially and environmentally responsible manner, by adopting good aquaculture practices.

Pond management means balancing production (anabolism) and decomposition (catabolism) processes. The aquatic environment provides food, space, shelter, and oxygen and it receives metabolites (faeces, ammonia gill excretion, CO_2, etc.) from the farmed organisms, phytoplankton, zooplankton, benthos, and other microbial communities. Decomposing faeces consumes oxygen, while ammonia and nitrite, which are potentially toxic, are released.

Best management practices (BMPs) for shrimp farming are a standardized set of farming practices to ensure the environmental and financial sustainability of shrimp farming systems. India is one of the leading shrimp exporting country, producing more than 0.7 million tonnes of farmed shrimp.

What are BMPs?

Best management practices (BMPs) for shrimp farming are a standardized set of farming practices to ensure the environmental and financial sustainability of shrimp farming systems. It includes the following key points:

1. Pond preparation methods
2. Water quality
3. Removal of organic wastages from pond bottom
4. Fertilization of the pond
5. Biosecurity systems
6. Seed selection
7. Stocking methods
8. Feed management
9. Disease management
10. Harvest methods

1. Pond preparation methods:

Following best management practices of pond preparation provides a cleaner environment for shrimp cultivation by adopting scientific methods to reduce the risk of diseases and other outbreaks. The following should be practiced while preparing ponds:

a. Maintain min water level 1.4 mt to maintain water holding capacity.

b. Disinfection before stocking with a powerful disinfectant helps to control microbial load of ponds.

c. Sludge management is equally important esp. in cases where the gap between two cultures is less. Sludge is a buildup of organic materials that accumulate in pond, mixes with inorganic materials. It causes algal bloom and growth of pathogens.

d. Use a powerful probiotic before and post stocking to control growth of harmful bacteria in ponds and also support shrimp health.

e. Managing mineral balance in ponds is important to ensure that the mineral requirements of shrimp are met.

2. Water quality

Water quality is the most important element to achieve a successful crop. The entire culture is dependent on this aspect and to maintain a good water quality, we must adopt following methods.

a) Maintain reservoir for water treatment.

b) Use double layered 60 mesh to avoid unwanted carriers and use 80 mesh below the inlet.

c) Use good quality bleaching powder (35% or 70%) for treatment, do not use any pesticide and insecticide.

d) Use triple salt compounds like **AquaCare 3D** to avoid pathogens in water.

e) To maintain healthy plankton bloom, apply fermented juices with yeast and apply good quality probiotics like **AquaCare Control**.

f) Chain dragging is also recommended when healthy bloom has not happened.

g) Use good quality minerals to maintain ionic balance in the water system especially calcium, magnesium, and potassium like **AquaCare Mineral Balance**.

3. Removal of organic waste from pond bottom

Organic matter releases toxic gases like ammonia and hydrogen sulphide in the pond leading to stress or death of shrimps. Organic waste is in the form of layer on the soil with black colour found in feeding area, corners, trenches and in the centre in ponds. Aerators should be checked for the presence of black layer when it is in wet condition. For removal of organic matter, following methods can be utilised:

a) Use *Nitrosomonas* and *Nitrobacter* probiotics along with Photo-synthetic bacteria like *Rhodocooccus* and *Rhodobacter* to remove nitrates and hydrogen sulphides.

b) Drying and ploughing of the pond enables oxidizing the organic matter and reducing the sludge.

c) Plough the soil for removal toxic gases and removal of gastropods and other unwanted debris.

d) To remove unwanted species apply good quality of teased cake around 40kg per acre.

4. Fertilization of the pond

Fertilization of the pond helps to balance the mineral content of the pond and increases pond carrying capacity as well as soil fertility. It can be achieved through:

a) Maintaining organic matter content at min. 1.5% - apply 500kg to 1000kg vermicompost or potassium humate at 80 kg per acre.

b) Apply good quality lime to maintain optimal pH of the soil.

c) Apply chelated zinc 6kg per acre.

d) For **EHP infected ponds**, use concentrated bleaching powder 100kg Potassium permanganate 6kg , Formalin 6 lt, Copper sulphate 6kg , Calcium oxide 800kg in water per acre; thoroughly mix and keep water for 6 days then drain out again and dry.

5. Biosecurity

Biosecurity in shrimp farming involves stocking disease free seed, pond preparation, water screening, prevention of entry of disease carriers, personal hygiene, and sanitation. Biosecurity plays a pivotal role in farming to maintain disease free environment.

a) To control carriers (Burrowing) use crab fencing with good quality nylon & lDPE materials.

b) Use bird fencing to avoid birds and its droppings preferably red and blue coloured threads.

c) Farming area should be clean and maintain sanitization dip at entry and exit areas.

d) Clean farm equipment and utensils regularly with potassium permanganate or any hypochlorite solutions to avoid cross contamination.

e) Maintain personal hygiene of the farm workers.

6. Seed selection & stocking methods

Selection of the seed is the one of the most important factors on which the entire crop depends.

1) Select seed from CAA certified hatchery with SPF bloodstock and PCR tested.

2) Before selecting the seed check your pond water conditions according to your salinity and do stress test in the hatchery with your pond water inputs.

3) Avoid wild seed and contaminated, unhealthy seeds.

4) Seed should be packed with sufficient aeration and good quantity artemia for longer transport.

5) Select good PL size (PL 15 to 20) is ideal.

6) Seed stocking should be done in early mornings or late evenings.

7) Before stocking maintain acclimatization process.

7. Feed management

Feed management is important for successful shrimp production and costs 50-60% of the total operational cost.

a) Monodon requires higher protein, omega-3, phospholipids and phosporus. A good quality feed like **Gamma** (for Vannamei) and **Kuroline** (for Monodon) which is specifically formulated to meet the requirements of species should be given.

b) The feed should not be more than 120 days from date of manufacture.

c) Follow feed chart as per your shrimp body size and weight to avoid wastage.

d) Reduce feeding by checking in check tray feeding.

e) Reduce feed in rainy and cloudy weather conditions as well as plankton crash and high temperatures.

f) Reduce feed in pre moulting and low DO conditions.

g) Regularly monitor ammonia and nitrate conditions.

h) Do regular sampling in every week to determine the growth, survival, and FCR.

i) Do not feed excess as it leads to pond water quality deterioration.

j) Feed should be stored in cleaned and good ventilated areas avoiding direct sunlight and keep feed in pallets and rodent free environment.

8. Disease management

Check the health of shrimp in feed check trays on daily basis. If there is poor feed consumption for consecutive three to four days, it indicates health problems. Check the general health and growth of shrimp collected by cast net on weekly basis.

Carry out sampling during early morning or late evening at different places.

1) Regularly check bacterial loads and water quality parameters.
2) Identify fouling and deformities.
3) Gut should be 80% filled with feed.
4) Observe antenna cuts and hepatopancreas colour.
5) During virus outbreaks sanitize with good sanitizers and use good probiotics on regular basis.
6) Avoid cross contamination by adopting hygienic methods.
7) Dead and affected shrimp should be buried outside the pond area.
8) Don't move equipment from affected ponds to unaffected ponds.

9. Post Harvest and Harvest methods

For freshness and quality of the shrimp, harvest methods are important:

a) Exchange 30% water before one week
b) Apply soil probiotics to avoid gill infections.
c) Apply oxidizers like Hydrogen peroxide or potassium permanganate to avoid black colouration.
d) Avoid harvesting in moulting period.
e) Don't feed before 6 hrs of harvesting.
f) Complete the harvest process in mornings to avoid discolouration.
g) After harvest apply lime and bleaching in the harvest area to avoid cross contamination.
h) Packing should be done with good quality ice.

About Skretting

Skretting is a global leader in providing innovative and sustainable nutritional solutions and services for the aquaculture industry working closely with shrimp and fish farmers. Our purpose is 'Feeding the Future'. Skretting has 30 production facilities in 18 countries on five continents and manufactures and delivers high-quality feeds from hatching to harvest for more than 60 species. The total annual production volume of feed is more than 3 million tonnes. It is headquartered in Stavanger; Norway and it employs 4,000 employees. Its team of more than 140 employees is dedicated to Innovation that works on the core competencies of nutrition, feed production and health for aquaculture. In India, we have head office in Hyderabad and our manufacturing footprint in Surat, Gujarat.

For further information, kindly write to us at contact.india@skretting.com or visit our website: www.skretting.in

ROLE OF BIOFERTILIZERS IN AQUACUTURE

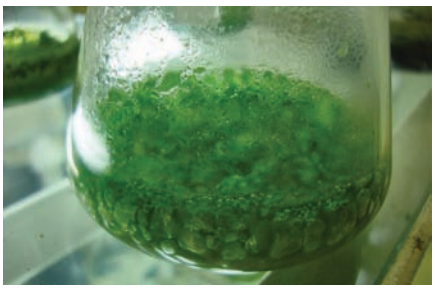
Email: **jayashriswamy22@gmail.com**

Jayashri Mahadev Swamy, Uday Kiran, Binal Khalasi and Ganapathi Naik. M

Department of Aquaculture, College of Fisheries, Mangalore, India
Department of Aquatic Environment Management, College of Fisheries, Mangalore, India.

Introduction

The modern aquaculture is focusing mainly on the stable supply of the synthetic chemicals called as fertilizers. Excessive dependence of these fertilizers leads to the adverse effects and effect the integrity of the ecosystem. Due to the adverse effects that they are causing has lead the scientific fraternity to look for the alternatives.



Bio fertilizers are broadly categorised into two types based on their mode of action

1. Nitrogen fixing
2. Phosphate solubilising

NITROGEN FIXING: Bacteria of this category performs nitrogen fixation when they are applied

Ex Rhizobium for legume crops, Azotobacter/azospirillum for non-legume crops

BGA for low land paddy and aquaculture

Nitrogen fixing biofertilizers:

- Free living or symbiotic bacteria and Blue green algae fix atmospheric gaseous nitrogen as ammonia and release it there by increasing fertility of soil and water.
- EX. Rhizobium, azotobacter, acetobacter, azospirillum.
- Rhizobium and azolla require symbiotic association to fix nitrogen and others fix independently.
- *Anabena azollae* living in aquatic fern(azolla) are very efficient nitrogen fixers, and contribute about 500 kg N/ha/yr.

PHOSPHATE SOLUBLISING: These biofertilizers they solubilise the phosphate that is present and makes it available for the soil and water. Phosphatic fertilizers is to be applied for all crops and it is applied with rhizobium, azotobacter, azospirellum.

Biofertilizers are ready to use live formulates of such beneficial microorganisms which on application mobilises the availability of nutrients with its biological activity. It helps in building the microflora and maintains the soil health. It is equivocally stated that biofertilizers can be used in agriculture. Field studies shows that about 30 kg of nitrogen can be saved by making use of cyanobacterial biofertilizers.

Phosphate solubilising biofertilizers:

- Phosphate solubilising microorganisms (PSM) secrete organic acids which enhance the uptake of phosphorous by plants dissolving rock phosphate and tricalcium phosphates.
- PSM (e.g. phosphatika) are particularly valuable as they are not crop specific and can benefit all crops

COMPOSTING BIOFERTILIZERS:

Composting Biofertilizer is a combination of microorganisms and compost. Composting biofertilizers are used for hastening the process of composting and for enriching its nutrient value. Composting process is enhanced by enzymes secreted by microorganisms to hydrolyse pectin's, xylans, hemicellulose and cellulose releasing beneficial micronutrients for the plants.

BIOFERTILIZERS USED IN AQUACULTURE

1. Azolla
2. Phosphatase bacteria and phosphate solublizing bacteria
3. Nitrogen fixing bacteria
4. Nitrogen fixing cyanobacteria
5. Enriched compost

1. AZOLLA: Azolla is a dichotomously branched (mode of branching of repeated bifurcation) free floating fern. It is widely disturbed on tropical belts in India showing its presence on moist soils, marshy ditches and pond. The shape of Indian species is triangular measuring about 1.5 to 3 cm in length and 1 to 2cm in breadth. Roots remained suspended in water and the dorsal lobe has a specific cavity for its symbiotic partner, Blue green algae. In the context of depletion of soil fertility and high price of chemical fertilizers it has become imperative to use them. Biofertilizers are cheap and renewable source of low cost plant nutrient
E.g., *Azolla Carolina*

The remarkable feature of azolla is that its symbiotic relationship with cyanobacteria (***Anabena azollae***) which remains on the dorsal side of the leaf cavity. The fern provides protein substances to anabena (BGA)

BGA then absorbs the atmospheric nitrogen and breaks into soluble ammonia. It can fix 3-7kg N/ha daily.

Ridged field rice azolla model

It is a integrated aquaculture system where paddy and rice grown together in which azolla is used as a biofertilizer. This design was originally developed for swampy areas with the objective of improving soil properties and increasing rice yield. Later it was, stepwise integrated with azolla and fish. Rice is planted on the ridge; azolla is used as feed by the fishes as well as biofertilizer for the paddy.

2. PHOSPHATASE BACTERIA AND PHOSPHATE SOLUBILISING BACTERIA

The bio-geochemical cycle of phosphorous is significantly influenced by the microbes that are present in the aquatic environment. Organic phosphorous compounds are decomposed and mineralised by enzymatic complexes (phosphatases produced by microbes). Enzymatic catalysis results in the production of organophosphate, which can be readily used by primary producers.

3. NITROGEN FIXING CYANOBACTERIA: Nostoc is a free living aerobically nitrogen fixing cyanobacteria. In addition, VAM fungi (vesicular arbuscular mycorrhizae) are free living soil forms that increases nutrient uptake by converting organic phosphorous into inorganic phosphorous. Rhizobium producing root nodules in legumes and anabena azollae living in leaf cavities of azolla contribute about 500 kg.N/ha/yr.

4. NITROGEN FIXING BACTERIA: Azotobacter species are free living (mostly root associated), aerobically nitrogen fixing bacteria. Rhizobium produces root nodules in legumes and there by fixes nitrogen.

ADVANTAGES:

There are many advantages in using biofertilizers as they are having broad range of advantages.

Here are some of the advantages of using biofertilizers

- ✓ Increases crop yield by 20-30%.
- ✓ Replaces nitrogen and phosphatic fertilisers by 25%.
- ✓ Stimulates plant growth.
- ✓ Activate soil biologically.
- ✓ Restore natural fertility.
- ✓ Increases soil organic matter content and maintains good soil texture.
- ✓ Environmentally friendly.
- ✓ Cheaper than fertilisers.
- ✓ Believed to have good promoting substances.

Provide protection against some soil borne diseases.

Conclusion:

Biofertilizers can be used in aquaculture these biofertilizers are economically profitable, ecologically friendly and are socially acceptable. Bio fertilizers usage in aquaculture have good ease of application and adaptability and enhances the productivity.

Hepatopancreatic Parvovirus (HPV) Disease – An Emerging Viral Infection in Penaeid Shrimps

Laishram Soniya Devi, David Waikhom, Maibam Malemngamba Meitei
ICAR-Central Institute of Fisheries Education (CIFE), Mumbai, India
Email: davidwaikhom3@gmail.com

Introduction

Globally, seafood demand has increased rapidly in recent years, leading to a substantial expansion in aquaculture, especially in commercially produced species, namely penaeid prawns and shrimps. To overcome the market demand leads to increased production, resulting in increased disease issues, mainly those with infectious aetiologies. Viral pathogens have promoted considerable economic losses within penaeid shrimp culture. HPV or Penaeus monodon densovirus (PmoDNV) of penaeid shrimp is an emerging shrimp virus that makes a significant financial loss in the shrimp industry and aquaculture. It infects several penaeid shrimp species worldwide and is detected frequently with other viruses. It was first reported in farmed marine shrimp in Singapore and is the relatively prevalent pathogen of wild, farmed, and hatchery-reared penaeid shrimp. This virus caused chronic mortalities in shrimp's early larval and post-larval stages and stunted growth in juveniles and adults.

Hepatopancreatic Parvovirus (HPV) Disease

Hepatopancreatic parvovirus (HPV) is a small, icosahedral, non-enveloped DNA virus with a single copy of the small (4-6 kb) viral chromosome of 22–23 nm in size, a single-stranded linear genome of 6321 nucleotides. HPV belongs to the family (Parvoviridae) and subfamily (Densovirinae), affecting invertebrates. Besides, in the CsCl density gradient, the HPV buoyant density value by isopycnic centrifugation was 1.412–1.425 g/ml. Howbeit, the HPV viruses'

- *Penaeus monodon densovirus* (PmoDNV) is an emerging virus that can significantly contribute to huge economic losses in shrimp aquaculture.
- Till now, ten strains of HPV have been reported from several countries, including India, Thailand, Australia, Korea, China etc.
- This pathogen can be diagnosed through various diagnosis methods such as clinical signs and symptoms, histopathology, molecular techniques, lateral flow chromatographic test, etc.
- In the line of preventive measures, both short-term and long-term strategies need to be undertaken to avoid the diseases caused by HPV.

classification is yet disputable due to their unusual capsid proteins and genome organizations. So far, five strains of the complete HPV genome from *P. monodon* (PmDNV) (India and Thailand), *P. merguiensis* (PmergDNV) (Australia), and *F. chinensis* (FcDNV) (Korea and China) have been identified and sequenced.

Clinical signs and symptoms

There is no one distinct sign of HPV infection. Generally, affected shrimps develop generalized disease symptoms such as appetite loss and retarded growth rate, discolored body surface and occasional opacity of tail/abdominal muscles. Benthic diatoms, protozoans, in particular, *Zoothamnium* sp., and filamentous bacteria may give rise to exoskeleton fouling in infected shrimps. Severe infections show whitish and atrophied hepatopancreas, anorexia and lowered preening activity. Losses may owe to the rising occurrence of surface and gill fouling organisms and secondary infections by the opportunistic Vibrio spp, which frequently mask the HPV infection effect. This virus leads to 100 % mortalities during outbreaks in the early larval and post-larval stages and stunted growth in the juvenile stages.

Host species and strains of HPV

The natural host range of the PmeDNV virus includes a growing list of cultured, captured, and hatchery-reared shrimp species, covering various stages of development from early larvae to adults. These species come from different parts of the world and include *Fenneropenaeus chinensis* (Chinese fleshy prawn), *Fenneropenaeus indicus* (Indian white shrimp), *Fenneropenaeus merguiensis* (banana shrimp), *Fenneropenaeus penicillatus* (redtail shrimp), *Litopenaeus stylirostris* (western blue shrimp), (*Litopenaeus*) *vannamei* (whiteleg shrimp), *Marsupenaeus japonicus* (kuruma shrimp), *Penaeus esculentus* (brown tiger shrimp), *Penaeus monodon* (giant tiger prawn) and *Penaeus semisulcatus* (green tiger prawn) (Syahidah, 2020) .

Interestingly, PmeDNV infection has been observed beyond penaeid prawns and has been recorded in the Mediterranean crab (*Carcinus mediterraneus*), the crayfish (*Cherax quadricarinatus*) and more recently, in the mud crab (*Scylla serrata*) of Australia. Additionally, there have been reports of an agent similar to HPV infecting brine shrimp.

Currently, ten strains of HPV have been reported. Among them, HPVchin was the first strain described in 1995 from *P. chinensis* (Korea), followed by *P. monodon* (PmoDNV) in 1999 (Thailand), *P. semisulcatus* (India), *P. merguiensis* (Australian). Further, other strains of HPV were recited in *P. monodon* from India, Madagascar, New Caledonia and Tanzania and *P. chinensis* from South Korea and China (Safeena et al., 2012). However, HPV reported from independent prawn species and geographic regions suggested a much more comprehensive host range than reported and widespread.

Impact of disease on the host

HPV infects the hepatopancreas, which typically causes necrosis and atrophy in young-juvenile stages and increases mortality, remarkably under stressful or overcrowded conditions. It is associated with slow growth without visible inflammatory response, decreasing shrimp production and lowering the profitability of shrimp farmers.

Target tissues and histopathology

The principal target organ of HPV is hepatopancreatic tissues. Histological examination in the HPV infected tissue showed that single, prominent, basophilic (hematoxylin and eosin stain), feulgen-positive intranuclear inclusion bodies in hypertrophied nuclei of hepatopancreatic tubular epithelial cells (hepatopancreatocytes) described by Lightner (1996).

Current Diagnosis methods of HPV Infection

Some of the current diagnosis methods available for HPV infection are given below:

- Wet mount Microscopy
- Tissue Imprint
- Histopathology
- Histological method (H&E staining)
- Positive diagnosis
- Transmission electron microscopy (TEM)
- Nucleic Acid-Based Diagnostic Techniques
    - Traditional PCR (Polymerase Chain Reaction)
    - Nested PCR
    - Real-Time PCR
    - Loop-Mediated Isothermal Amplification (LAMP)
    - PCR–Enzyme-Linked Immunosorbent Assay (PCR–ELISA)
    - Probe Techniques
    - In Situ Hybridization
    - Dot Blot Hybridization
- Monoclonal Antibody (MAb) Based Techniques
- Lateral flow chromatographic test
- Infection bioassay

Geographical distribution and spread of the disease

HPV is one of the arising diseases of crustaceans, especially in shrimp. It was first reported in various Indo-Pacific region countries (Australia, China, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand) in the mid-1980. Eventually spread to different corners of the world, including Africa (Kenya), Madagascar, the Middle East (Israel and Kuwait), and the Americas (Brazil, Colombia, Ecuador, El Salvador, Hawaii, Honduras, Mexico, and Peru).

Transmission of HPV

Naturally, HPV is transmitted horizontally and vertically. Horizontal transmission is easier in the larval stage, while vertical transmission is through parentage. HPV can be transmitted through contaminated water, cannibalism or infected artemia in horizontal contamination. Though vertical transmission is not likely, eggs can still be contaminated into spawning tanks with infected female faeces or from parental broodstock to F1 progeny.

Threat to penaeid shrimp and prawn Farming

HPV is believed to be a potential threat to shrimp and prawn farming due to the following reasons:

1. HPV infects all stages of farmed shrimps, such as early larvae, postlarvae, juveniles and adults.

2. It has a vast host range and is spread worldwide

3. Chronic mortality in early larval or post-larval stage and slow growth rates in juvenile stages.

4. In many cases, HPV has been found to occur as dual infections with MBV and its mortality rates can range from 50-100% of the affected populations within four weeks of the onset of the disease.

Prevent and control Disease Outbreaks

At present, no peculiar antiviral treatments or vaccinations against HPV are available and therefore preventive and control strategies are still the best practices to lessen disease occurrence.

Short term solutions to diseases caused by HPV include

- Screening the post-larvae before stocking shrimp by routine histology or the Giemsa-impression smear method or (SMP) PCR or quantitative real-time PCR kits
- Quarantine and Screening of all aquaculture inputs having the potential to carry HPV, such as imported parental brood-stock, seed, fresh and live feed, before placing in tanks or farms.
- Used HPV-free stocks or seeds and destroyed infected shrimp.
- Checking cohabiting fauna for the potential carriers of the disease.
- Not feeding female broodstock six hours before moving to spawning tanks to reduce eggs/embryos contamination with HPV infected faeces and reinforcing eggs and nauplii washing and disinfection before transferring to hatchery tanks to reduce possible HPV contamination from broodstock faeces
- Removing sick or dead shrimp to prevent transmission through cannibalism
- Proper technical assistance for active farm level monitoring periodically with appropriate diagnostic tools for early detection of disease and complex factors in farm or hatchery management.

Longer-term solutions for HPV include

- Good sanitary and good management farming practices
- Implementation of numerous biosecurity practices in farming and hatchery systems,
- Genetic improvement program of disease tolerance or resistance for shrimp of HPV disease through a genomic selection

Recent technologies available for HPV detection:

- ✓ Shrimp MultiPath™ (SMP) PCR
- ✓ Quantitative real-time PCR kits (Green Star and Dual Star kits)

Conclusion

The high food demand of the world's ever-growing population gives more emphasis to food-producing sectors. Intensification of Aquaculture is the ray of hope in this sector to meet such a goal by applying high stocking density intensive farming, especially in the shrimp aquaculture industry, which has high-value food. As a result, new emerging diseases are being reported rapidly. Therefore, proper aquaculture practices in shrimp farms must be adopted to avoid the outbreak of diseases, including HPV, that has a potentially massive economic loss to shrimp aquaculture and industry.

References:

Bonami, J.R., Mari, J., Poulos, B.T. and Lightner, D.V., 1995. Characterization of hepatopancreatic parvo-like virus, a second unusual parvovirus pathogenic for penaeid shrimps. *Journal of General Virology*, *76*(4), pp.813-817.

Bower, S.M., McGladdery, S.E. and Price, I.M., 1994. Synopsis of infectious diseases and parasites of commercially exploited shellfish. *Annual Review of Fish Diseases*, *4*, pp.1-199.

Ganjoor, M., 2015. A short review on infectious viruses in cultural shrimps (Penaeidae family). *Journal of FisheriesSciences. com*, *9*(3), p.1.

Lavilla-Pitogo, C.R., Lio-Po, G.D., Cruz-Lacierda, E.R., Tendencia, E. and de la Peña, L.D., 2000. *Diseases of penaeid shrimps in the Philippines*. Aquaculture Department, Southeast Asian Fisheries Development Center.

Liu, T., Yang, B., Song, X., Wang, X., Yuan, Y., Liu, L. and Huang, J., 2013. Detection and quantification of hepatopancreatic parvovirus in penaeid shrimp by real-time PCR assay. *Journal of invertebrate pathology*, *114*(3), pp.309-312.

Phuthaworn, C., Nguyen, N.H., Quinn, J. and Knibb, W., 2016. Moderate heritability of hepatopancreatic parvovirus titre suggests a new option for selection against viral diseases in banana shrimp (Fenneropenaeus merguiensis) and other aquaculture species. *Genetics Selection Evolution*, *48*(1), pp.1-10.

Roubal, F.R., Paynter, J.L. and Lester, R.J.G., 1989. Electron microscopic observation of hepatopancreatic parvo-like virus (HPV) in the penaeid prawn, Penaeus merguiensis de Man, from Australia. *Journal of Fish Diseases*, *12*(2), pp.199-201.

Safeena, M.P., Rai, P. and Karunasagar, I., 2012. Molecular biology and epidemiology of hepatopancreatic parvovirus of penaeid shrimp. *Indian Journal of Virology*, *23*(2), pp.191-202.

Tang, K.F., Pantoja, C.R. and Lightner, D.V., 2008. Nucleotide sequence of a Madagascar hepatopancreatic parvovirus (HPV) and comparison of genetic variation among geographic isolates. *Diseases of aquatic organisms*, *80*(2), pp.105-112.

Yan, D.C., Tang, K.F.J. and Lightner, D.V., 2010. A real-time PCR for the detection of hepatopancreatic parvovirus (HPV) of penaeid shrimp. *Journal of fish diseases*, *33*(6), pp.507-511.

Syahidah, Dewi (2020) Assessment of cell cultures to propagate crustacean viruses. PhD Thesis, James Cook University. https://doi.org/10.25903/fxzn-7x89

Color Enhancement of Ornamental Fishes:

Procedure and Suggestions to the Farmer

Nayan Chouhan[1] and Bhavesh Choudhary[2]

[1]*Ph.D. Research Scholar, Department of Aquatic Health & Environment, College of Fisheries, Central Agricultural University (Imphal), Lembucherra, Agartala, Tripura, India.*

[2]*Ph.D. Research Scholar, Department of Aquaculture, College of Fisheries, Central Agricultural University (Imphal), Lembucherra, Agartala, Tripura, India.*

Email: bhaveshchoudhary@yahoo.com

Introduction:

Ornamental fishes, known for their vibrant colors and mesmerizing patterns, has become an integral part of multibillion global aquarium trade industry. These fishes are highly valued for their aesthetic appeal, and their brilliant colors are a significant factor in their popularity among hobbyists and collectors and have long captivated the hearts of aquarists and hobbyists around the world. Their vivid colors, graceful movements, and intricate patterns make them a centerpiece of many aquariums. While genetics play a crucial role in determining the natural coloration of these fishes, there are certain techniques and procedures that farmers can employ to enhance and maintain the vividness of these colors. The allure of these colorful aquatic creatures is undeniable, making them a highly sought-after commodity. The males of majority of ornamental fishes are used for marketing purpose due to presence of attractive color patterns, but nowadays there is increasing trend of sex reversal via diet alteration at larval level fish to convert female to male is highly practiced to ensure great profit from farm raised fishes. In this guide, we will explore the importance of vibrant colors in ornamental fish, the economic benefits of color-enhanced varieties, and provide a comprehensive overview of the steps and procedures that farmers can employ to enhance the colors of their ornamental fish.

Understanding Fish Coloration and enhancement:

While many ornamental fish species naturally exhibit striking colors, some individuals may benefit from color enhancement to reach their full aesthetic potential. To delve into the distinction between natural and enhanced colors and discuss when color enhancement is both safe and ethical. Before delving into the methods of color enhancement, it's essential to understand the factors that influence the coloration of ornamental fishes. Fish colors are primarily determined by genetics, diet, environmental factors, associated stress and overall fish health. Selective breeding has resulted in many strains of ornamental fish with specific color traits, but environmental factors and proper care play a significant role in bringing out the best in these colors. In variety of fish species breeders have created numerous color varieties and most popular species of fishes are Siamese Fighting Fish, Discus, Tetras (various species), Goldfish, Guppy, Molly, Platy, Angelfish, Chichlids (various species), Parrotfish (various species), and other locally available indigenous fishes are more amenable to color enhancement than others. We'll identify popular species known for their dazzling color potential and discuss the possibilities for enhancing their natural beauty.

HIGHLIGHT POINTS

Color enhancement of ornamental fishes necessitates a combination of inputs from farmers and hobbyists such as optimum nutritious diet, care, proper conditions. This article addresses how farmers can improve color at the field level and what components are crucial in this process. Farmers can earn more profit in the ornamental fish sector by using this strategy, and when people see these colorful fish, they become attracted to the ornamental sector. Color enhancing techniques give the fishes vibrant colors, beautiful patterns, and shades.

A. Procedure

1. Selecting the right species:
The foundation of color enhancement starts with selecting the right species of ornamental fish. Some species are naturally more vibrant than others, and some have been bred specifically for their striking colors. Multi colors are obtained by using different fish species.

2. Check Quality Water Parameters:
Maintaining pristine water conditions is essential for color development. The second and most crucial step in color enhancement is to ensure the fish are living in a pristine aquatic environment. Water quality parameters such as temperature, dissolved oxygen, pH, ammonia, nitrite, and nitrate levels should be regularly monitored and maintained within the appropriate range for the species. Poor water quality can stress the fish, leading to dull and faded colors. When the quality of fish kept water is good, the fishes are not prone to attack by any infection or very less chance because good water quality stimulates the body immunity of the fishes. So the farmers are suggested that regular monitoring of water quality parameter, water exchange (Every 3-4 days). and proper filtration are essential for providing the good environment to the fishes

3. Provide color enhance supplement through suitable diet and their doses
A balanced diet plays a pivotal role in enhancing fish colors. A well-balanced and nutritious diet is essential for the overall health and color enhancement of ornamental fishes. Fishes require a diet rich in proteins, carbohydrates, fats, vitamins, and minerals for good growth and display vibrant colors. Depending on the species, specialized color-enhancing foods containing natural color enhancers like astaxanthin and spirulina can be beneficial. Live or frozen foods like brine shrimp, daphnia, and bloodworms can also be incorporated into the diet for added variety and nutritional benefits. Understanding the role of pigments in fish coloration is essential. Here we discuss some researcher work on specific nutrients and pigments and their doses that contribute to vibrant hues and suitable in fisheries sector to achieve this goal.

Koi carp and gold fish fed with Paprika@ 171 mg/kg shown bright red color in the skin [Hancz et al. 2003]. Use of *Chlorella vulgaris*, *Haematococcus pluvialis* and *Arthrospira maxima* @ 80 mg/kg in koi carp and gold fish improved the color of both the species [Gouveia et al. 2003]. Gold fish fed with astaxanthin from red yeast @ 60 mg/kg increased the pigmentation in the flesh, scales, head and fin [Xu et al. 2006]. Rainbow trout fed with red chilli (*Capsicum annuum*) oleoresin @ 120 mg/kg exhibited no significant colour loss during processing [De la Mora 2006]. Dietary incorporation of *Haematococcus pluvialis* at 50 mg/kg in Red porgy developed pink-coloured skin [Tejera et al. 2007]. Dietary incorporation of alfalfa @ 15mg/kg improved pigmentation in the tissues [Yanar et al. 1997]. Japanese ornamental koi carp fed with *Spirulina platensis* @ 75.0 g/ kg improved pigmentation [Sun et al. 2012]. Dietary incorporation of Spirulina platensis meal @ 7.5 mg/kg improved better pigmentation [Teimouri et al 2013]. Dietary incorporation of Paprika and H. pluvialis @ 100 mg/kg extract exhibited better skin pigmentation in Olive flounder [Pham et al. 2014].

4. Artificial Color-Enhancing Supplements and their doses (commercial color-enhancing products):
There are specialized artificial color-enhancing supplements available in the market that can be added to the fish's diet. These supplements contain additional pigments and nutrients that can intensify the colors of your fish. Follow the manufacturer's guidelines when using such supplements. The market offers various color-enhancing products. Here also we provide some artificial supplements use by researcher and their doses in fishes.

Astaxanthin (Naturose®) at the rate of 100 mg/Kg increased bright reddish color in both dorsal and ventral areas of Red porgy [Chatzifotis et al. 2005]. Astaxanthin @ 4.7-32.8 mg/Kg received higher dark color in tropical spiny lobster than that of control fishes [Barclay et al. 2006]. Red porgy fed with 25 or 50 mg/Kg of astaxanthin exhibited reddish hue pigmentation in animals [Tejera et al. 2007]. Dietary incorporation of astaxanthin at a rate of 39 mg/Kg gave higher pigment retention in the skin of Australian snapper [Doolan et al. 2008]. Japanese ornamental carp fed with Synthetic carotenoid (Carophyll) @ 1.5 g/kg improved pigmentation [Sun et al. 2012]. Dietary incorporation of xanthophylls (Wisdem Golden Y20) @ 75 mg/Kg exhibited 1.10–1.20 times greater yellowness color in ventral skins and 1.25–1.35 times greater in dorsal skins of Yellow croaker [Yi et al. 2014].

5. Proper administration of color-enhancing additives:
The proper administration and dose calculation of different natural and synthetic coloring agent is must know before enhancing the color in the fishes.

B. Various tips / suggestion to farmers for success in enhancement of color in ornamental fishes

1. Provide Proper Light:
Light is another crucial factor in bringing out the vibrant colors of ornamental fishes. Adequate and appropriate lighting not only highlights the fishes' colors but also stimulates their natural behaviors. LED lighting with adjustable color spectrums can be used to create a visually appealing environment. It's important to provide a proper photoperiod, mimicking natural day and night cycles, which can vary based on the fish species. Light in aquarium also help in several other ways in ornamental fish keeping like increase feed acceptance, natural breeding, release reproductive hormone etc.

2. Tank Decoration and Background:
Creating the right environment within the tank is essential. The choice of tank decoration and background can significantly impact the visual appeal of ornamental fishes. Substrate, plants, and decorations should be chosen thoughtfully to complement

the fish's colors and provide hiding places for them. A dark-colored background can help make the fish's colors pop, creating a stunning visual effect. Substrate and plants provide proper place for egg deposition of some ornamental fishes. Use of proper plants play an important role in breeding, place for hiding.

3. Stress Reduction:
Stressed fish often exhibit dull colors. Minimizing stress factors such as sudden water parameter fluctuations, aggressive tankmates, and overcrowding is crucial. Proper acclimation when introducing new fish, providing sufficient hiding spots, and maintaining a peaceful tank environment can significantly reduce stress, allowing the fish to display their best colors. If the fish keeper is able to reduce the stress in aquarium, then the color is improved in those fishes.

4. Selective Breeding:
If the farmer is involved in breeding ornamental fishes, selective breeding for desired color traits is a long-term approach to color enhancement. By choosing the most vibrantly colored individuals as parents, subsequent generations are more likely to inherit and express those vibrant colors. Patience and careful observation of breeding outcomes are key in this method.

Ethical Considerations (Avoiding excessive color enhancement, Ensuring the well-being of the fish)
The usage of coloration-enhancing diets in ornamental fish raises significant ethical concerns that revolve around the well-being of these aquatic creatures and the potential impacts on the environment (Sloman et al., 2019). While the appeal of vibrant and strikingly colored fish may attract hobbyists, the consequences of artificially manipulating the pigmentation of these animals deserve careful consideration. Altering the natural coloration of fish through specialized diets may compromise their overall health. These diets often prioritize aesthetics over nutritional balance, potentially leading to deficiencies in essential nutrients and causing long-term harm to the fish. Furthermore, the stress of being subjected to unnatural diets and the effects of color-enhancing additives can weaken the fish, making them more susceptible to diseases and reducing their lifespan. The environmental implications of color-enhancing diets cannot be ignored. The production and widespread use of such diets may contribute to pollution, disrupt aquatic ecosystems, and strain natural resources. A more ethical approach to appreciating ornamental fish involves responsible breeding practices that prioritize the health and natural beauty of the fish without compromising their well-being or the environment (Baron et al., 2008). It is essential to prioritize the long-term health and welfare of these captivating aquatic creatures and maintain the delicate balance of our aquatic ecosystems. If any health concerns arise during the enhancement process, immediate action is crucial.

Conclusion: Sustainable practices for long-term benefits
Color enhancement of ornamental fishes requires a combination of proper care, nutrition, environment, and, in some cases, selective breeding. By focusing on water quality, diet, lighting, tank decor, stress reduction, and genetics, farmers can create an ideal environment for their ornamental fishes to display their most vibrant and beautiful colors. Remember, patience and dedication are keys to successful color enhancement, and the joy of seeing your fish display their full splendor is truly priceless. The result is not only visually appealing but also contributes to the well-being and happiness of the fish, making the hobby of ornamental fishkeeping a rewarding experience for both the farmer and the enthusiasts.

References:
Barclay MC, Irvin SJ, Williams KC, Smith DM. Comparison of diets for the tropical spiny lobster, Panulirus ornatus: astaxanthin supplemented feeds and mussel flesh. Aquaculture Nutrition 2006;12(2):117-125.

Baron, M., Davies, S., Alexander, L., Snellgrove, D., & Sloman, K. A. (2008). The effect of dietary pigments on the coloration and behaviour of flame-red dwarf gourami, Colisa lalia. Animal Behaviour, 75(3), 1041-1051.

Chatzifotis S, Pavlidis M, Jimeno CD, Vardanis G, Sterioti A, Divanach P. The effect of different carotenoid sources on skin coloration of cultured red porgy (Pagrus pagrus). Aquaculture Research 2005;36(15):1517-1525.

De la Mora GI, Arredondo-Figueroa JL, Ponce-Palafox JT, Vernon-Carter JE. Comparison of red chilli (Capsicum annuum) oleoresin and astaxanthin on rainbow trout (Oncorhyncus mykiss) fillet pigmentation. Aquaculture 2006;258(1):487-495.

Doolan BJ, Booth MA, Allan GL, Jones PL. Effects of dietary astaxanthin concentration and feeding period on the skin pigmentation of Australian snapper, Pagrus auratus (Bloch & Schneider, 1801). Aquaculture Research 2008;40(1):60-68.

Gouveia L, Rema P, Pereira O, Empis J. Colouring ornamental fish (Cyprinus carpio and Carassius auratus) with microalgal biomass. Aquaculture Nutrition 2003;9(2):123-129.

Hancz C, Magyary I, Molnar T, Sato S, Horn P, Taniguchi N. Evaluation of color intensity enhanced by paprika as feed additive in goldfish and koi carp using computer-assisted image analysis. Fisheries science 2003;69(6):1158-1161.

Pham MA, Byun HG, Kim KD, Lee SM. Effects of dietary carotenoid source and level on growth, skin pigmentation, antioxidant activity and chemical composition of juvenile olive flounder, Paralichthys olivaceus. Aquaculture 2014;431:65-72.

Sloman, K. A., Bouyoucos, I. A., Brooks, E. J., & Sneddon, L. U. (2019). Ethical considerations in fish research. Journal of Fish Biology, 94(4), 556-577.

Sun X, Chang Y, Ye Y, Ma Z, Liang Y, Li T et al. The effect of dietary pigments on the coloration of Japanese ornamental carp (koi, Cyprinus carpio L.). Aquaculture 2012;342:62-68.

More references can be provided on request.

INTEGRATED TAXONOMY – New dimension to explore the fish diversity

M. Kishore Kumar, P. Ramesh, G. Thayala Arjun
Fisheries College and Research Institute, Tamil Nadu Dr J. Jayalalitha Fisheries University, Thoothukudi

Email: kishorekumarjothi@gmail.com

Abstract
The population discrimination and species identification are essential in the conservation of biodiversity, natural resources and fisheries management. Traditionally, identification of species has relied on morphological and meristics characteristics, but these methods often encounter problems with reliability as some of the fish species are cryptic. More recently, fish otolith, scale and bone also used by fish taxonomist as one of the taxonomic tools to delineate the species. There are so many biochemical and molecular methods too available for the identification of fish species. This article discusses the merits of employing various taxonomic tools to study the fish taxon, collectively known as "Integrated taxonomy".

- 1. Recent taxonomist for identification of species, use of fish otolith, fish scale, fish bone and molecular methods as one of the taxonomic tool to identify the species.
- 2. Integrative taxonomy is described as a comprehensive approach to naming a species.
- 3. The geometric morphometric analysis methods were used to determine if scale morphology can discriminate between genera, species, geographic variants, and fish stocks.
- 4. The morphometric analysis of fish otolith is difficult because of the concave form of otoliths and overall variability of shape Knowledge of the concepts of morphometric analysis is needed in order to utilize this method.
- 5. The accuracy of fish scale identification usually exceeds 70 percent and the resolution is high, identifying upto population level.

Integrated taxonomy
The term "integrative taxonomy" was coined by Day rat (2005) to describe a comprehensive approach to naming species. DNA sequencing technologies, access to museum collections, information about phylogenetics and phylogeography, advances in evolutionary studies and computer tomography have revolutionized conventional taxonomy in such a way that conventional taxonomy could be supplemented and complemented with information generated from all the above approaches. Species delimitation and a scientific consensus on naming could be achieved now by using a combination of different methods along with traditional taxonomy tools and this is the objective of integrative taxonomy. In other words, it brings together all available knowledge regarding many aspects of a single group of species so as to form a comprehensive picture of the degree and kind of similarities and differences that are to be found within such a group.

INTEGRATED TAXONOMIC TOOLS
Fish scale
The fish scales are used as an identification tool for differentiation among fish species. The geometric morphometric analysis methods were used to determine if scale morphology can discriminate between genera, species, geographic variants, and fish stocks. This method is used because it allows standard multivariate analyses while preserving

information about scale shape, which is important in making biological interpretation of results. This method was tested on ctenoid scales from mullets collected from different areas of the Gulf of Mexico and Aegean Sea by Ibanez et al. (2009). This method is non-destructive, quick and less costly than genetic analysis, thus allowing many individuals to be screened. The genus Mugil was even better segregated as *Mugilcephalus*was well separated from other species. *Mugilcurema* more closely resembled to *Chelonlabrosus* and *Liza saliens*. These results agree with genetic studies of the mugilidae that indicate remarkable genetic divergence in *Mugilcephalus* and *Mugilcurema* compared with other family (Caldara *et al*., 1996).

Otolith

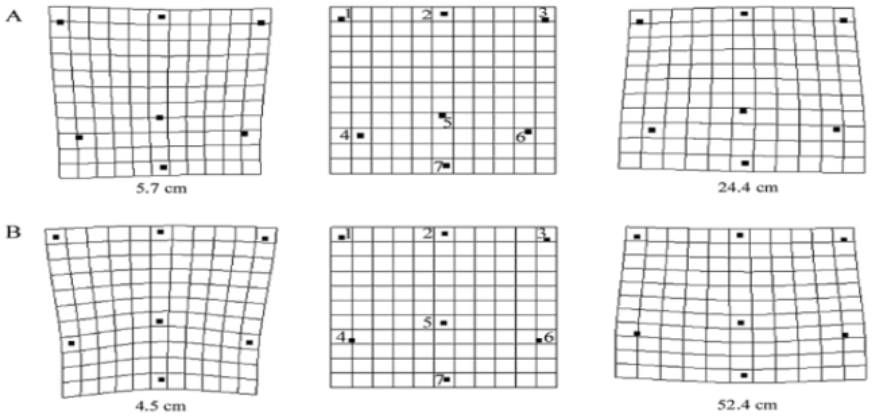
This method is more laborious than the use of fish scales and also requires more knowledge and training, due to its superior accuracy (exceeding 80 percent for congeneric species). The main limitation of this identification tool consists in its destructiveness (the extraction of otoliths kills the fish) and in the fragility of the otoliths, as they easily break during extraction and manipulation. In addition, the morphometric analysis is difficult because of the concave form of otoliths and overall variability of shape Knowledge of the concepts of morphometric analysis is needed in order to utilize this method.

(Adapted from V´ıctor M. Tuset a, *et al.,)*

The development of digital techniques using shape analysis have offered fishery biology new possibilities of research to identify stocks by means of morphometric characters of fish or otoliths (Campana and Casselman, 1993; Bolles and Begg, 2000; Begg*et al*., 2001) Recently, new analysis based on outlines using bending energy, waveletsand curvature scale space analysis were tested on otolith shape identification (Parisi-Baradad*et al*., 2005; Piera*et al*., 2005). With the development of different shape analyses, otolith shape analysis has also been used in the identification of fish species (Lombarte*et al*., 1991; L'Abee-Lund and Jensen, 1993; Tuset*et al*., 2003). Shape descriptors of saccularotoliths (sagittae) obtained by image analysis were investigated for the identification of three species of genus Serranus inhabiting the Canary Islands by (Victor M. Tuset*et al*., 2006). The study of morphological characteristics of fish otoliths has been considered to be important in recent years to identify fishes in palaeoichthyology (Gaemers, 1984; Nolf, 1985, 1995) and trophic ecology (Durr and Gonzalez, 2002; Moreno ´ Lopez *et al*., 2002). Generally, the sagittal otoliths are the most widely used in comparative taxonomy works because of their large size, degree of inter-specific variation and relative ease by which the structures can be accessed (Nolf, 1985). The otolith morphology in Aphanius is known to represent a valuable tool for the taxonomy, and is also indicative for the genetic diversity of a particular population revealed by (Bettina Reichenbacher, 2009).

Fish Scales

Fish scales have been extensively used in fish species identification since the early 1900s. Not only is their count important in key classification; also descriptions of their shape and particular features have been used in keys to recognize families or distinguish between close species. The accuracy of this identification tool usually exceeds 70 percent and the resolution is high, allowing identification at population level. In addition, the method is appealing as scales offer a cheap, rapid and reliable identification of fish using easily extractible body parts (scales) in a non-destructive manner (thus allowing rare and endangered species to be returned to the water). Research and development of the method should be improved as a baseline is needed for many species, including many that are commercially exploited.



(adapted from Ana L. Ibánez*et al.)*

Molecular methods:

Several molecular genetic methods have been applied to fisheries-related taxonomic problems to identify and distinguish closely related species. Barcoding is defined as the use of a standardized short region of DNA to verify species identity, which typically for fish is the CO1 region of mitochondrial DNA, with the generation of publicly accessible and highly comparable data. All publicly accessible data are available from one website (Barcode of Life Database), and information on specimen vouchers, photographs and other biological information is available from the same site. Currently, the practice relies on high throughput DNA sequencing,

which is typically undertaken by commercial sequencing centres. More sophisticated and expensive molecular methods, based on DNA extraction, followed by sequencing or restriction enzyme digestion, are increasingly used for similar identification problems (Bartlett and Davidson 1992), including shark species (Martin, 1993; Heist and Gold, 1998). Unlike other biochemical techniques, such as allozyme and DNA markers, the protein fingerprints revealed by IEF show little intraspecific variation (Lundstrom, 1981). Most individuals from the same species have identical protein fingerprints. When protein fingerprints vary among individuals from the same species, the differences are restricted to the presence or absence of one or a few of the protein bands; the majority of bands are shared among all individuals.

An increasing number of studies and techniques have become available to identify different animal species. Histological analysis of tissues, fatty acids composition, antigen–antibody gel diffusion (Kangethe, Gathuma & Lindqvist, 1986), SDS-PAGE (Zerifi, Labie & Bernard, 1991), ELISA-assays (Andrews, Berger, Mageau, Schwab & Johnston, 1992; Martin, Wardale, Jones, Hernandez & Patterson, 1991) and Isoelectricfocusing (IEF) (King, 1984; Renon, Colombo, Colombo, Biondi & Malandra, 2001) are only some of the numerous techniques available for the species identification. Recently, molecular methods based on nucleic acids amplification (PCR) have been developed and employed to reach the goal of the species differentiation. Usually PCR is coupled with other techniques able to detect differences in the sequence of the products obtained by PCR amplification. So far restriction fragment length polymorphism (RFLP) (Meyer, Hofelein, Luthy & Candrian, 1995) and single strand conformation polymorphism (SSCP) (Rehbein, Kress & Schmidt, 1997) have been the techniques most frequently used for this purpose. Regarding fish-species identification, methods such as IEF (AOAC, 1998), liquid chromatography (Osman, Asoor & Marsh, 1987), immuno-diffusion (Carrera et al., 1996) and molecular methods (Barlet & Davidson, 1991; Cespedes et al., 1998; Cocolin, D'Agaro, Manzano, Lanari & Comi, 2000; O'Reilly & Wright, 1995) have been used.

Osteology:

The osteological identification of fish species includes the collection of paired head bones for premaxilla, maxilla, lower Jaw and opercular were taken for identification and the results will show the significant differences among bones of species which were described and compared in both intergeneric and interspecific relationship of species. Morphometric and meristic characteristics which are affected by external ambient; however the osteological traits enhance the other characters, since these features are useful to make identification keys for their distinction (Nasri et al., 2013; Mafakheri et al., 2014). The jaw bones are considered to be important characteristics to separate the groups of symmetric species in teleostean fishes Osteological studies provide additional information for a better understanding of the phylogeny of cyprinid fishes (Alkahemet *al*., 1990). Several studies were focused

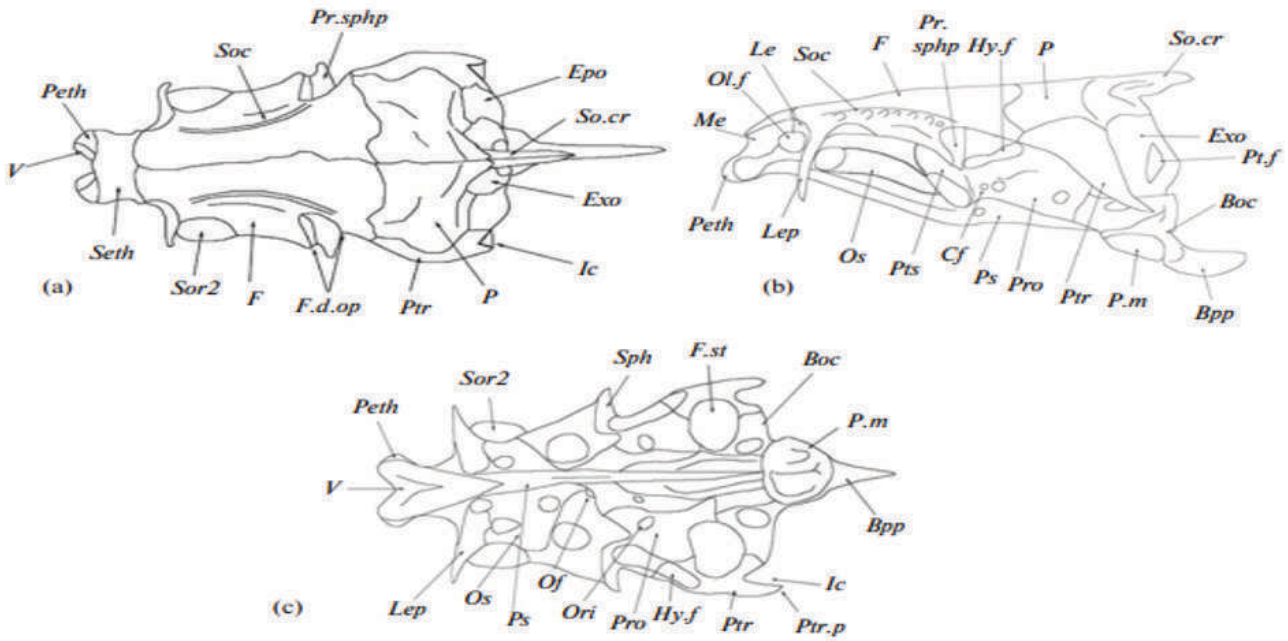


Fig. 1. Neurocranium of *C. macrostomum* (*SL* = 9.2 cm) in dorsal (a), lateral (b) and ventral (c) views (*Bpp*—basioccipital posterior projection; *Boc*—basioccipital; *Cf*—carotid foramen; *Epo*—epiotic; *Exo*—exoccipital; *F*—frontal; *F.D.Op*—dilatators fossa; *F.St*—subtemporal foramen; *Hy.F*—hyomandibular joint face; *Ic*—intercalar; *Le*—lateral ethmoid; *Lep*—lateral ethmoid process; *Me*—mesethmoid; *Of*—optic foramen; *Ol.F*—olfactory foramen; *Ori*—orifices; *Os*—orbitosphenoid; *P*—parietal; *P.m*—masticatory plate of pharyngeal process; *Peth*—preethmoid; *Pr.sphp*—lateral process of sphenotic; *Pro*—prootic; *Ps*—parasphenoid; *Pt. f*—posttemporal fossa; *Ptr*—pterotic; *Ptr.p*—pterotic process; *Pts*—pterosphenoid; *Seth*—supraethmoid; *So.cr*—supraoccipital crest; *Soc*—supraorbital sensory canal; *Sor2*—supraorbital 2; *Sph*—sphenotic; *V*—Vomer). Scale bar 5 mm.

(Adapted from M. Nasri, *et al*.,)

on fish taxonomy based on fish bones such as Takahashi (1962), which identification species using vertebral column, Qasim (1973) investigated the osteology of *Luciobarbusxanthopterus* and *M. sharpeyi* with special reference to their lateral-line system Nasri*et al*., (2013).

Advantages of employing integrated taxonomic tools:

1. Isoelectric focusing is a relatively quick and cheap identification technique (Lundstrom, 1981) compared with DNA-based extraction methods
2. Several molecular methods includes DNA barcoding which is useful for identification of different fish species diversity and also identification and confirmation of new species. The application of molecular methods to the identification of the species in this study was found to be useful, fast and reliable.
3. Osteological studies provide additional information for a better understanding of the phylogeny of fishes.
4. Bones morphology is a good tool to determine the variance intergeneric and interspecific to investigate the phylogeny traits among species, genera and families and understanding the range of environmental and genetic influences on modification of bones which helpful the fauna to live in their habitat.
5. Fish-scale shape is especially useful for discrimination among genera, species and also sympatric populations.
6. Fish otolith is more laborious than the use of fish scales and also requires more knowledge and training, due to its superior accuracy.

Conclusion:

In recent times, the application of integrated taxonomical methods is one of the main tool for the identification of fish diversity. Traditional methods including morphology and meristics based identification methods is not used alone but the combination of all types of integrated taxonomical tools play a vital role and also it will give the clear cut idea about the individual fish species and it act as a taxonomic library.

References:

1. Alkahem, H.F., RJ, B. and Ahmad, Z., 1990. Some osteological distinction among four Arabian cyprinid species. Japanese Journal of Ichthyology, 36(4), pp.477-482
2. Caldara, F., Bargelloni, L., Ostellari, L., Penzo, E., Colombo, L. and Patarnello, T., 1996. Molecular phylogeny of grey mullets based on mitochondrial DNA sequence analysis: evidence of a differential rate of evolution at the intrafamily level. Molecular Phylogenetics and Evolution, 6(3), pp.416-424.
3. Comi, G., Iacumin, L., Rantsiou, K., Cantoni, C. and Cocolin, L., 2005. Molecular methods for the differentiation of species used in production of cod-fish can detect commercial frauds. Food Control, 16(1), pp.37-42.
4. Heist, E.J. and Gold, J.R., 1999. Microsatellite DNA variation in sandbar sharks (Carcharhinusplumbeus) from the Gulf of Mexico and mid-Atlantic Bight. Copeia, pp.182-186.
5. Ibáñez, A.L. and O'Higgins, P., 2011. Identifying fish scales: the influence of allometry on scale shape and classification. Fisheries Research, 109(1), pp.54-60
6. Nasri, M., Keivany, Y. and Dorafshan, S., 2013. Comparative osteology of lotaks, Cyprinion kais and C. macrostomum (Cypriniformes, Cyprinidae), from Godarkhosh River, western Iran. Journal of Ichthyology, 53(6), pp.455-463
7. Piñeiro, C., Barros-Velázquez, J., Pérez-Martín, R.I. and Gallardo, J.M., 2000. Specific enzyme detection following isoelectric focusing as a complimentary tool for the differentiation of related Gadoid fish species. Food Chemistry, 70(2), pp.241-245.
8. Reichenbacher, B., Kamrani, E., Esmaeili, H.R. and Teimori, A., 2009. The endangered cyprinodont Aphaniusginaonis (Holly, 1929) from southern Iran is a valid species: evidence from otolith morphology. Environmental Biology of Fishes, 86(4), p.507.
9. Tuset, V.M., Rosin, P.L. and Lombarte, A., 2006. Sagittal otolith shape used in the identification of fishes of the genus Serranus. Fisheries Research, 81(2-3), pp.316-325.

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.

Postal Regn. No. HD/1068/2024-2026
Published on 7 February 2024