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MPEDA prepares Action Plan for Aquaculture Development in Odisha

Eliciting sound waves of any frequency without regulation in our area of interest will not ascertain the expected result. Finding out the resonant frequency is the fundamental principle of using the ultrasonic wave. For instance, consider targeting a pathogen or a parasite from a fish. The 'fish' and the 'pathogen attached along with the fish' are having different resonant frequencies.

The February 2023 issue of Aqua International is in your hands. In the news section you may find news about ...

Aqua International published a special feature on Aquaculture in Odisha. The Marine Products Export Development Authority prepared State Action Plan for Aquaculture Development in Odisha and other states in India. Odisha has been given more scope and potentiality for aquaculture development. The feature also contains interviews with some stakeholders like Falcon Feeds & Marine Exports, Hari Marine Group, Snow World Marine Exports Pvt Ltd, Save Sea Food, Aquamed Pvt Ltd and Aquaculture Employees Association.

Kings Infra Ventures Ltd focusing in aquaculture farming, seafood processing and international trade of marine products will join hands with Atomes Group for developing and promoting antibiotic-free sustainable and traceable aquaculture in the country. The two companies have signed a Memorandum of Understanding in this regard recently. The deal between the two companies will enable antibiotic-free aquaculture products which will enable better access and acceptability of the aquaculture products in the international market.

Aquaculture contributes approximately 80 per cent of global aquaculture production is currently taking place in Asia. Yet, it's long been assumed that much of Asian aquaculture has been implemented on a small scale. However, the size and tenure of aquaculture farms have been poorly documented. The factors that drive and mediate aquaculture change have been understudied in the past, and there are a few sources of publically available data on the boundaries of aquaculture ponds, commented Dr Ben Belton, associate professor with the MSU Department of Agricultural, Food and Resource Economics.

Setting target to make Manipur one of self-reliant state in fish production, Directorate of Fisheries had organised first ever fish fair on Emoinu Eratpa Numit, a ritual ceremony of Meitei community in which fish are offered to Goddess Imoinu Ahongbi, goddess of wealth and prosperity on 3 January 2023. The fair was named as Emoinu Fish Festival and held at Hapta Kangjeibung, Imphal East organised by department of Fishery. It was participated by fish farmers from various districts of Manipur.

Central Marine Fisheries Research Institute has entered into an MoU with Emineotech, a health products focused company, last week to commercialize a seaweed based liver health product. The managing director of Emineotech, Evanjalist Pathrose and Dr A. Gopalakrishnan, Director of CMFRI, executed the license

Contd on next page

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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.

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agreement. "Commercialization of the product will be greatly beneficial to a large number of people suffering from non-alcoholic fatty liver disease because it helps improve liver health, reduce the disposition of fatty substances and maintain other liver / lipid parameters within the clinically acceptable limits." According to the findings of in-depth pre-clinical trials, the nutritional supplement does not cause any adverse effects.

In the Articles section – **Ultrasonic Wave against Pathogens in Aquaculture and its Various Applications in Fisheries,** *authored by* Anisha Valsalam and Megha Kadam Bedekar, Ph D Student, Aquatic Animal Health Management Department, Principal Scientist, Aquatic Animal Health Management Department, ICAR - Central Institute of fisheries Education, Mumbai discussed about usage principle though the ultrasound wave technology has various applications, utilizing it for pathogen removal in aquaculture systems is still not commercialized in India. Eliciting sound waves of any frequency without regulation in our area of interest will not ascertain the expected result. Finding out the resonant frequency is the fundamental principle of using the ultrasonic wave. For instance, consider targeting a pathogen or a parasite from a fish. The 'fish' and the 'pathogen attached along with the fish' are having different resonant frequencies. So targeting the pathogen needs only to find out its resonant frequency to solve the problem, which is quite tricky because of the uniqueness of the frequency from one organism to another. Once the resonant frequency is known, the other environmental factors affecting the process need to be addressed.

Proper utilization of ultrasonic resonance frequency breaks the cells of the pathogen resulting in its death. The spreading of energy using the sound wave over massive areas results in the reduction of the power per area, which is called 'geometric scattering'. Hence the area of treatment should be near the source of the ultrasonic wave generator for better results. As the sound wave propagates, some energy is absorbed depending on the temperature, pressure and salt content of the medium. The factors such as scattering, reflection and deflection contribute to the weakening of the sound wave as the wave propagates to a more considerable distance.

Article titled – **Salinization of Soil and Water,** *authored by* Dr Jayashri Mahadev Swamy, Dr Ganapathi Naik M, Shrinivaas K.H and Monica K.S, Department of Aquaculture, College of Fisheries, Mangaluru said about Salinization is the process by which water-soluble salts accumulate in the soil. Salinization is a resource concern because excess salts hinder the growth of crops by limiting their ability to take up water. Salinization may occur naturally or because of conditions resulting from management practices. Irrigation management and drainage Irrigation systems are never fully efficient. Some water is always lost in canals and on the farmers' fields. Part of these seeps into the soil. While this will help leach salt out of the rootzone, it will also contribute to a rise of the water table; a high water table is risky because it may cause the salts to return to the rootzone. Therefore, both the water losses and the water table must be strictly controlled. This requires careful management of the irrigation system and a good subsurface drainage system.

Article titled – **Recirculating Aquaculture System: A Future Technology of the Blue Revolution,** Lokesh Pawar, Tanik Das, Krishan Kumar Yadav, Arzoo Khan and Mayuri Nag,*College of Fisheries (Central Agricultural University- Imphal), Agartala, Tripura, College of Fisheries, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand* said the status of RAS in India, fish production through RAS has not yet gained much attention due to the high initial investment and lack of skilled labour. But commercial rainbow trout culture through RAS has gained popularity in recent time and in this regard, ICAR - DCFR (Directorate of Coldwater Fisheries Research) has been working for the last four years. To mitigate the problems associated with conventional trout farming, ICAR - DCFR has successfully designed and established a pilot project at Bhimtal, Uttarakhand, for the farming of rainbow trout through RAS.

The production capacity of the project is 2 metric tons per year, but this system is mainly used for research and demonstration purposes. ICAR - DCFR has also designed, established, and validated hatchery and nursery RAS for incubating trout eggs and rearing trout fry in different locations. ICAR - DCFR also successfully experimented with egg incubation and fingerling production, which can also be possible in adverse weather conditions in Ladakh through controlled RAS conditions. Currently, two commercial RAS - based rainbow trout farming facilities have been established in India, namely one at Awantipora in Kashmir with a system volume of 500 m^3 and a production capacity of 15 tons, and another at Hyderbad, Telangana, with a production capacity of 300 tons.

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.

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

M.A.Nazeer
Editor & Publisher
Aqua International

Workshop on Promotion of GIFT Tilapia, Sea Bass Culture and Mud Crab Fattening

The Technical Workshop on 'Promotion of GIFT Tilapia, seabass culture and modern technique of mud crab fattening in West Bengal (WB)' was organized by Department of Fisheries, Government of West Bengal on Google Meet platform on 17/1/2023. Dr S. Kandan, Director, Rajiv Gandhi Centre for Aquaculture (RGCA), the R&D unit of MPEDA, Government of India was the main resource person and invitee in this programme.

Dr Kandan gave an account on the initiatives taken by RGCA for promoting diversified aquaculture in India by producing good quality seeds of commercially-important and export-oriented aquaculture species like GIFT Tilapia, black tiger shrimp, mud crab instar, Asian seabass, Pangas catfish on commercial mode - aiming at enhancing production. He informed about the thirteen ongoing RGCA projects and their locations; Govt assistance, quality feed and seed, technology standardization, dissemination of improved technology as major requirements for successful commercial aquaculture; diversified fishery resources available and opportunities for fishery and aquaculture in WB. According to him, the Asian seabass *Lates calcarifer* is most-preferred, has high value and a potential cultivable fish for freshwater (warmwater), brackishwater and marine water in WB. GIFT *Tilapia nilotica* (not genetically modified) also holds high potential in domestic and international markets. *Scylla serrata* with export value can become an alternative source of livelihood and income for marginal farmers in coastal WB.

Likewise is the potential of Specific Pathogen Free (SPF)-*Penaeus monodon*. RGCA offers technical services on hatchery & seed production units of these species, nursery units and grow-out facilities, hands-on training. MPEDA is the 2nd largest shrimp exporter in the world and have offices in abroad. Dr Kandan diagrammatically explained the estimated production and income, *i.e.*, impact of seabass seeds supplied from RGCA till 2021-22; expenditure and income involved in both nursery rearing and growout farming of seabass; impact of *S. serrata* seeds supplied from RGCA's commercial mud crab hatchery (the biggest in SE Asia); phase-wise culture and production particulars of *S. serrata* upto adult from crab instar; expenditure, income and profit involved (model economics of 0.5ha pond). He highlighted the salient features (area covered, achievements, etc) of RGCA's Aquaculture Demonstration Farm project for *S. serrata* and *L. calcarifer*; the open pond culture (phase-wise) and cage culture methods of *L. calcarifer* have been standardized. BMP (Best Management Practices) of the two species is being demonstrated in training programmes.

Participants online were informed about impact (total quantity, area promoted, production, income, etc) of GIFT Tilapia seeds supplied by RGCA. Their project on 'Demonstration of *P. monodon*' involves domestication of *P. monodon* wild stock, selective breeding, production of SPF broodstock having better growth and survival, supplying parental post-larvae to Broodstock Multiplication Centres, production of healthy seeds. As one of RGCA's achievements, production of 6-10 generations of SPF-*P. monodon* was done. Dr Kandan spoke about broodstock management of *Litopenaeus vannamei*, important features of cage farming of seabass, that sexes of the fish are not separate which pose a big challenge for its breeding in controlled conditions. He showed photos of cannular biopsy of *L. calcarifer*, egg maturity determination, 7-8 years old broodstock (seabass broodstock bank of RGCA), weaning formulated feed for 20 days-old larvae with 55-45% protein content and fortified nutrients, harvest of seabass from cages. Participants were shown a Video on supplementary feeding (0.2-4.0mm extruded floating pellets) to seabass in cages; equal (even) size fishes are harvested from grow-out cages. He expressed his viewpoints about the possibility of setting up one seabass hatchery and one mud crab hatchery in WB in future. More amount of rotifers needed for megalopa larvae of *S. serrata*.

Dr Kandan also spoke about seabass culture in cages in ponds and cages in open sea/bays, structure and dimension of cages separately (2x2x1.5cub. mt for ponds, 2mt water depth and 5x5x3cub. mt for sea, 12+mt water depth), stocking density of juveniles (1-2nos/sq.mt and 5nos/sq.mt respectively), and other aspects. Body of seabass does not have much slime (mucous layer), which Indian major carps have. In USA, 40% of chicken meat has been replaced by *Tilapia nilotica* - the fish referred as 'aquatic chicken'. In WB, culture of all-male GIFT Tilapia can be popularized and promoted in a commercial manner, which can be exported. About 3000-above farmers each in Kerala and Maharashtra are doing GIFT culture after procuring seeds from RGCA - no much disease incidence, fast growth with good quality meat; genetically-improved all-male only to have best possible growth. In selective breeding of *T. nilotica*, sixty families of the fish have been produced and maintained at RGCA facility at Manikonda village, near Vijaywada, Andhra

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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

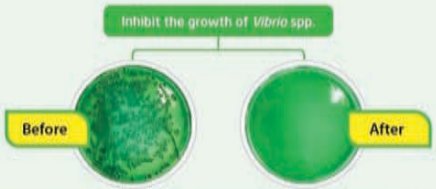
Prevent the accumulation of toxic substances such as NH_3, NO_2, etc.

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:

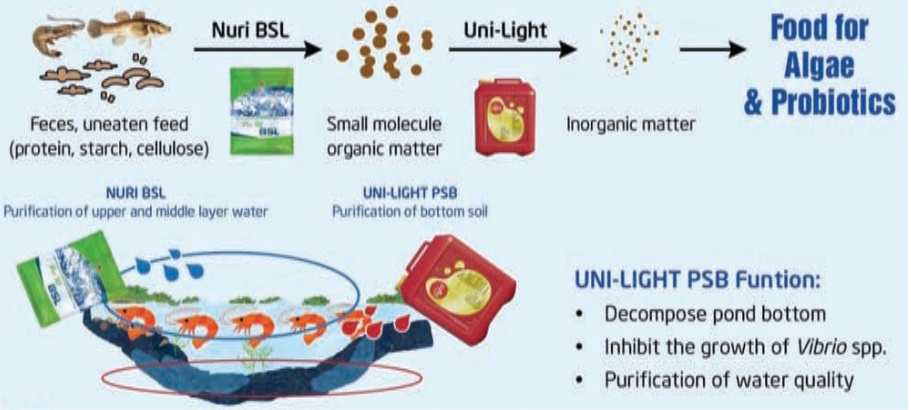
Bacillus spp. > 1x 10^{11} cfu/kg	15%
(Bacillus subtilis, Bacillus amyloliquefaciens, Bacillus licheniformis)	
Carrier (rice bran, corn gluten)	75%
Moisture	10%

* 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.*

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Pradesh. Participants were shown a Video on 'RGCA's gift to Indian aqua-farmers'; the techniques of water filtration; families of *T. nilotica* maintained individually and separately in breeding hapa enclosures in biosecured pond; collection of broodstock; lip clipping of male fish; releasing brooders into breeding hapa; egg collection, disinfection, estimation and incubation; estimation of hatch-out fry, their stocking and grading in indoor hatchery; feed incorporated with testosterone hormone and feeding - everything was explained. Dr Kandan emphasized on hatchery seed production and aquaculture of mud crabs - wild collection should not be entertained.

After Dr Kandan, a Presentation titled 'West Bengal - Sunshine in the East' was made by Sri A. Lahiri, Deputy Director, *MPEDA* Regional Division at Kolkata. Connoting WB as Aqua Goldmine, Sri Lahiri mentioned that only 35% area is utilized out of the total potential area available for brackishwater aquaculture in WB; that this state contributes to nearly 8% in overall marine products export basket from India. WB is blessed with the fertile Indo-Gangetic delta, here fishery and aquaculture industry is moving rapidly towards Value-added Products. He described salient features of soft-shell mud crab farming undertaken by MPEDA in Sundarbans region of WB, export of the same from Kolkata airport to UK and other places, Demonstration project on farming of the same in Basanti Block, South 24 Parganas district, Scampi Demonstration project undertaken by MPEDA in North 24 Parganas, mud crab Demonstration project (a RGCA technology) in Hasnabad Block.

In addition to these, Sri Lahiri spoke about item-wise export of seafood products from WB in 2022; major achievements of MPEDA in WB; that 47% of total export of mud crab of India occurs from Kolkata airport; mud crabs from Gujarat and Pakistan are transported to coastal districts in WB, fattened for 15 days, unpleasing pungent smell is eliminated and made suitable for export; both mud crab fattening and soft-shell mud crab farming can be taken up by women of Sundarbans region and Purba Medinipur district (live crab production and export); good quality export-oriented mud crab and *P. monodon* produced by aqua-farmers in WB; that ELISA laboratory has been established at Haroa and Contai towns in North 24 Parganas and Purba Medinipur districts respectively for testing quality of pond-grown *P. monodon*; and highlighted other relevant and important aspects. Higher Authority of Department of Fisheries, WB (including high-ranking officers of Directorate of Fisheries, WB and BENFISH); officers of all District Fishery Headquarters; Block-level officers participated in this informative Technical Workshop. News communicator Subrato Ghosh could gain knowledge from the Workshop.

Kings Infra Joins Hands with Atomes to Develop Antibiotic - free Aquaculture

Kings Infra Ventures Ltd focusing in aquaculture farming, seafood processing, and international trade of marine products will join hands with Atmoes Group for developing and promoting antibiotic-free sustainable and traceable aquaculture in the country. The two companies have signed a Memorandum of Understanding in this regard recently.

Kings Infra - Atomes MoU signing ceremony

The deal between the two companies will enable antibiotic-free aquaculture products which will enable better access and acceptability of the aquaculture products in the international market.

Elimination of antibiotics from the food system has emerged as an important quality standard in all developed markets with the concern over the health hazards posed by antibiotic-resistant bacteria becoming a reality. Going forward, zero antibiotics residue in food products, including aquaculture products, will be a primary criterion in all major markets. Elimination of antibiotic residue will be an essential ingredient for further growth of our processors and exporters.

According to the MoU, Kings Infra and its subsidiary SISAT360 will have exclusive rights for Atomes products to be used in the aquaculture industry across India. Kings Infra will also have the exclusive right to appoint Distributors, Agents or sell directly to end use customers.

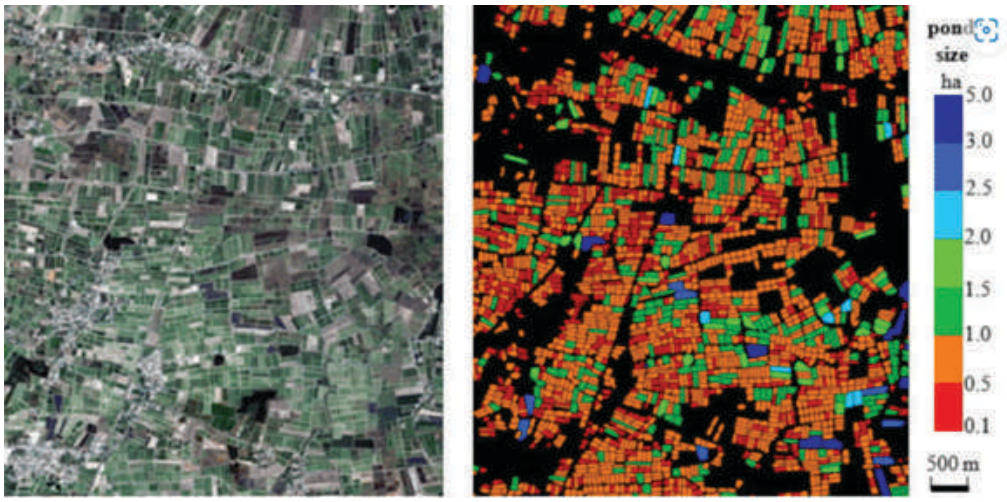
Kings Infra will do joint technology trials for the effectiveness to customize the products and the packaging to Indian conditions. Training and technical support to farmers and dealers by way of seminars, presentations etc. will be provided by the Atomes team.

The Canada-based Atmoes Group is a conglomerate with global presence in several verticals such as public hygiene, animal health, agriculture, pulp and paper, petroleum, food

Contd on Page 18

MSU researchers land NASA grant to study Asian aquaculture

A grant of nearly $800,000 from the NASA Land Cover / Land Use Change (LCLUC) program, will allow researchers from Michigan State University (MSU) to assess the extent of aquaculture operations in Bangladesh, India, Myanmar and Thailand.



A satellite image covering 6 × 7 km of central Thailand

Using satellite imagery and survey information, Drs Lin Yan, Ben Belton and David Roy will analyse how the industry is driving land cover and land use change in aquaculture hot spots.

"Aquaculture contributes substantially to global food and nutrition security and is projected to expand further in response to demand from an increasingly populous, affluent and urbanising world. When implemented sustainably, aquaculture can contribute substantially to addressing the challenges of global food and nutrition security. Yet, for many years, poor practices have often led to significant environmental damage in areas where it is employed," Dr Yan, assistant professor with the Center for Global Change and Earth Observations (CGCEO) at MSU, told Diane Huhn at MSU Today.

"Approximately 80 percent of global aquaculture production is currently taking place in Asia. Yet, it's long been assumed that much of Asian aquaculture has been implemented on a small scale. However, the size and tenure of aquaculture farms have been poorly documented. The factors that drive and mediate aquaculture change have been understudied in the past, and there are few sources of publicly available data on the boundaries of aquaculture ponds", commented Dr Ben Belton, associate professor with the MSU Department of Agricultural, Food and Resource Economics.

"This research is of great academic interest but also has practical implications for policies affecting land use and aquaculture in key global aquaculture hot spots," said Dr Roy, professor of geography and the interim director of the CGCEO.

Work on the 3-year grant will commence in early 2023. Focal areas for the team will include the Ayeyarwady Delta in Myanmar, southwestern and northern parts of Bangladesh, the Central Plains around Bangkok in Thailand, and the Andhra Pradesh Province of India.

Dr Belton is a rural sociologist specializing in Asian aquaculture. Currently based in Malaysia, he has conducted aquacultural surveys across Asia. Combining the survey data with high-resolution satellite imagery, the team will work to characterise the use of aquaculture in these regions by type and scale and explore hypotheses to understand the drivers and constraints of aquacultural change.

"This work is an important part of the Center's mission to use the latest geospatial technologies to improve human and societal well-being while supporting global efforts to increase the use of sustainable aquaculture and lessen its potential negative impacts on the environment," said Dr Roy.

Courtesy: thefishsite.com

Contn from Page 16 : ***Kings Infra Joins Hands with Atomes to Develop Antibiotic-free Aquaculture***

and beverage, aerospace and military.

Atomes India Chemicals Private Limited, the Indian arm of the Canadian Group, having many years of research and experiments in biochemical products covering animal health care, water and wastewater treatment, agriculture and pulp paper and MEPCO Limited, with over 20 years of experience in the Gulf has branched out into Pulp and Paper trading, the petroleum industry and the biochemical business will also be part of the deal.

According to the MoU the two parties agree to work together for developing antibiotic free, sustainable and traceable aquaculture in India.

Kings Infra Ventures Ltd, listed in BSE, is a technology driven aquaculture company focusing on sustainable and eco-friendly farming practices.

Capacity building centre for aquaculture inaugurated at Punjab vet varsity, aims to bring 'blue revolution'

The centre at Guru Angad Dev Veterinary and Animal Sciences University in Ludhiana has been developed under Pradhan Mantri Matsya Sampada Yojana (PMMSY) for Rs 139.05 lakh.

Sagar Mehra, DoF joint secretary, said the GADVASU was the first university to receive 100 per cent funding for the project under the PMSSY and the developed Centre is being visualised as a catalyst to boost Blue Revolution (increasing fisheries production and productivity from aquaculture and fisheries resources) in the region, in special reference to enthusiastic youth seeking self-reliance.

Ludhiana: Jatindra Nath Swain, secretary of the department of fisheries (DoF), Union Ministry of Fisheries, Animal Husbandry and Dairying, inaugurated a capacity-building resource center for intensive aquaculture technologies was inaugurated at Guru Angad Dev Veterinary and Animal Sciences University (GADVASU) in Ludhiana Saturday.

The center has been developed under Pradhan Mantri Matsya Sampada Yojana (PMMSY) for Rs 139.05 lakh and will serve as a prospective resource for demonstration, capacity building and innovative research and development for upscaling intensive aquaculture technologies like recirculatory aquaculture and biofloc-based aquaculture systems as per regional needs and climate, said GADVASU vice-chancellor Dr Inderjeet Singh.

Such water-saving technologies are essentially required for fulfilling production targets for food security and economic growth of the nation, he added.

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Swain said aspiring entrepreneurs of the region looking forward to adopting new and advanced technologies will benefit from the facility offering hands-on training and incubation opportunities to the stakeholders. The fisheries department is encouraging the development of recirculatory and biofloc aquaculture systems with a major focus on capacity building and scientific innovations, he added.

The DoF delegation visited veterinary clinics, livestock farms and exhibitions by various colleges of the GADVASU and departments of food science and technology; soil sciences and soil and water engineering in Punjab Agricultural University (PAU).

The DoF delegation also interacted with the fish and shrimp farmers of the state to address their concerns and requirements, Farmers were persuaded to make cooperatives to curtail seed, feed, marketing and processing-related challenges. Two young professional degree-holder entrepreneurs, Khushwant Singh (M.F.Sc) and Gurwinder Singh (M.V.Sc.), who started shrimp farming after completing their postgraduation from the university, were also honoured.

Department of Fisheries conducts two-day 'Annual plan preparation' workshop for Commissioners/ Directors of all States/UTs'

Satate / UTs have made tremendous efforts to increase fish production

- *The workshop aims to brainstorm, share information and resolve on-ground challenges **through effective and efficient planning by fisheries' officials of all States/UTs***
- *The workshop focused on the formulation of strategies with the states/UTs for the Annual Action Plans (2023-24 and 2024-25), it also served as an opportunity for peer learning and interaction (amongst states/UTs) facing similar challenges*
- *The workshop concluded with high fervor to plan **and work effectively and efficiently for the overall growth and development of the fisheries and** aquaculture sector*
- ***A total of 47 officials from 26 States/UTs attended** the workshop and made it a grand success*

Department of Fisheries , Government of India organised a two-day 'Annual Plan Preparation' workshop from 4th to 5th January 2023 to brainstorm, share information and resolve on-ground challenges through effective and efficient planning by fisheries' officials of all States/ UTs. The workshop was chaired by Shri Jatindra Nath Swain, Secretary, DoF (GoI) in presence of senior officials of Department of Fisheries (GoI), NFDB and states' fisheries department. A total of 47 officials from 26 States/UTs attended the workshop and made it a grand success.

The workshop started with the inaugural session in which JS (IF), DoF, welcomed all dignitaries and participants. He summarised the achievements of ongoing departmental schemes namely Pradhan Mantri Matsya Sampada Yojana (PMMSY), Fisheries Infrastructure Development Fund (FIDF) and Kisan Credit Card (KCC). He indicated that tremendous efforts have been put in by states/ UTs for increasing fish production whilst gaps exist in prioritising other aspects of the fisheries' value chain at state level. This has necessitated rectification actions to be taken up by relooking and replanning upcoming state/ UT annual plans.

Joint Secretary (MF) in his address emphasized on the formalization of the fisheries sector, enhancing domestic fish consumption, introduction of performance-based incentives for value chain efficiencies and quality assurance, shifting from fresh to frozen fish, branding, digital marketing, precision aquaculture, aquaculture insurance, entrepreneurship mentoring, co-management models, low-cost modern fishing vessels, vessel monitoring system and energy efficient fishing boats.

Chief Executive, NFDB in her address highlighted the progress and achievements of sub activities of PMMSY in the states/UTs. The gaps in physical progress of states/UTs was highlighted while development of coastal fisher communities, training and capacity building, cluster development, FFPOs, convergence, river ranching, aqua parks etc were emphasized upon.

Secretary, DoF (GoI), in his inaugural speech put forth his views on the ongoing activities and urged the states/UTs to set priorities at a local level along with the priorities of the Government of India. He advised that special attention may be given to sufficient seed production-as the most basic activity to propel the sectoral activities, take on

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

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a collaborative approach amongst states and centre for activities such as installation of artificial reefs, cold-chain, MIS data management, expansion of fish markets (Fish Bazaar), promotion and marketing of frozen fish, production of required number of seed etc. Priority areas mentioned along with the strategic rationale are likely to serve as guidelines for state/UT officials to set priorities for chalking out FY 2023-25 detailed annual action plan. In addition, he emphasized, that each state/UT should evaluate their resources and current situations to formulate their detailed annual action plans.

Post the inaugural session, the States/UTs presented their physical and financial achievements in FY 2020-21 and 2021-22, highlighted on-the-ground challenges faced and overview of the annual plans for the upcoming years 2023-24 and 2024-25. The interactive session led to inter-state discussions, exchange of good practices for problem-solving along with guidance from the leadership. In its last leg of day one, the session concluded with the summary and context setting for the next day.

On the second day of the workshop, group activities were done in three different groups followed by a presentation by the group leader. The group discussion entailed a cross-pollination of thoughts, and innovative ideas to resolve on-ground challenges and issues.

The workshop focused on the formulation of strategies with the states/UTs for the Annual Action Plans (2023-24 and 2024-25).It also served as an opportunity for peer learning and interaction (amongst states/UTs) facing similar challenges. During the event, presentation and discussion on Management Information System (MIS), Direct Benefit Transfer (DBT), and Single Nodal Account (SNA) were also organized to share process overview and address queries.

The event successfully concluded with an address by Joint Secretary (MF) wherein he summarized the key take-aways from the sessions and revisited the focus areas and important decisions. The workshop thus concluded with high fervor to plan and work effectively and efficiently for the overall growth and development of the fisheries and aquaculture sector.

Background:
The flagship scheme of Pradhan Mantri Matsya Sampada Yojana (PMMSY) was launched in September 2020 for a period of FY 2020-25 with the highest ever sectoral investment of Rs 20050 crore. The Department of Fisheries (GoI) has been endowed with a huge responsibility of bringing in structural changes and sectoral reforms and has been tirelessly putting efforts in mobilising, guiding, and supporting States/UTs for sanctioning strategic projects that will pave way for achievements of the PMMSY targets and objectives.

Under PMMSY, a total investment of Rs 11,318.00 crore (FY 2020-23 till date) has been done in various projects across all States/UTs. It was observed that both Centre and States/UTs may come together at a common platform to discuss ongoing challenges and issues for gap analysis and discuss corrective measures to achieve scheme objectives and overall growth of the fisheries sector.

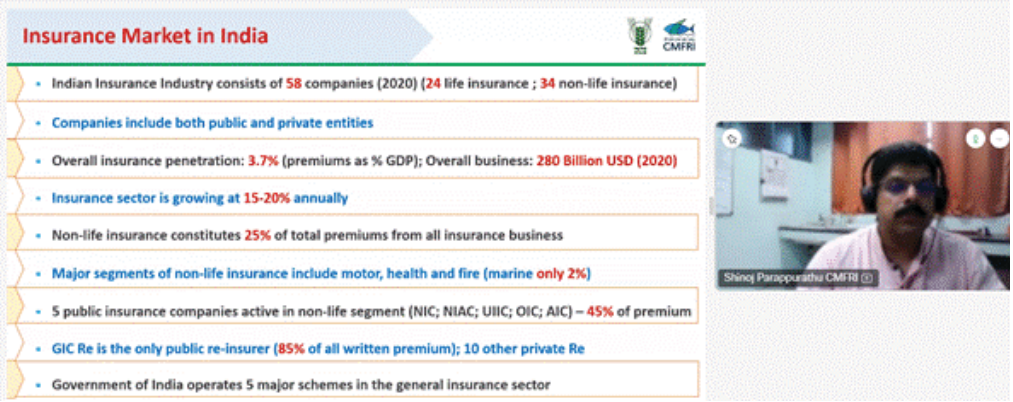
Secretary Fisheries, Govt of India Visits ICAR-CIFA

Bhubaneswar: Jaindra Nath Swain, IAS, Secretary, Department of Fisheries, MoFAHD, Govt. of India visited ICAR-Central Institute of Freshwater Aquaculture today. Sri Swain inaugurated CIFA-GI Scampi hatchery cum nursery complex. He also visited the farm facilities and other infrastructure at the Campus. Dr P. K. Sahoo, Director, ICAR-CIFA & National Professor and Senior Officers of the Institute explained him about the progress of various dimensions of Freshwater Aquaculture research being conducted at the Institute. In his address to scientists and officers of this institute he stressed on creating visible impact and forging close collaboration with state counterparts for disseminating the farm worthy technologies to farming community. Centre, state, entrepreneurs and other stakeholders need to work cohesively towards sustainable development of aquaculture.

Department of Fisheries conducts National Webinar on "Insurance Coverage for Fisheries and Aquaculture"

- *More than 170 participants from across the country attend event*
- *Technical sessions on various topics held*
- *Q&A session with distinguished speakers and clarifications on practical and on-the- ground issues and possible actions and development of new insurance products held during the event*

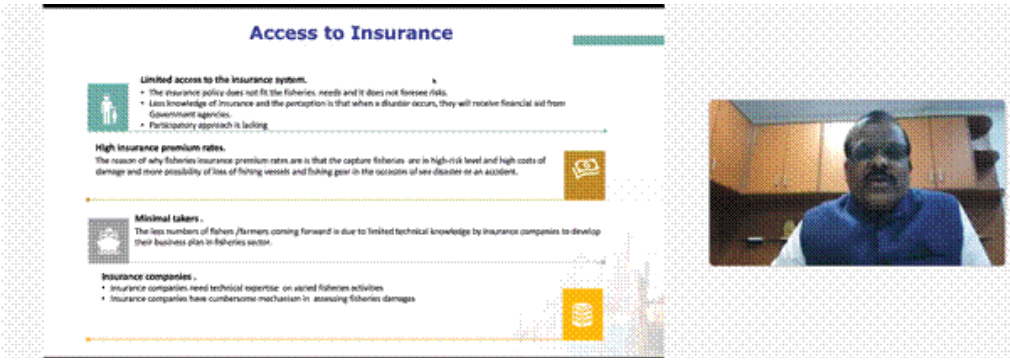
Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India organized a National Webinar on "Insurance Coverage for Fisheries and Aquaculture" on 29th December, 2022 as a part of ongoing celebration of Azadi Ka Amrit Mahotsav. The event was presided over by Shri Jatindra Nath Swain, Secretary, Department of Fisheries (DoF), Government of India (GOI) and well-attended by more than 170 participants from across the country. These included fishers, farmers, entrepreneurs, fisheries associations, officials of Department of Fisheries, GoI and fisheries officials of different States/ UTs, faculties from State Agriculture, Veterinary and Fisheries universities, Fisheries research institutes, Fisheries cooperative officers, Scientists, students and stakeholders from fisheries across the country.



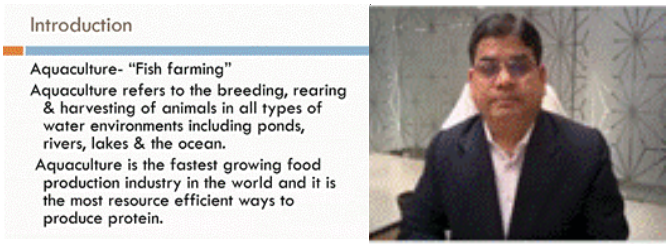
Dr Shinoj Parappurathu, Senior Scientist, ICAR-CMFRI, delivers presentation on "Fisheries and Aquaculture Insurance in India: Opportunities and Challenges".

Shri Jatindra Nath Swain, Union Secretary, Department of Fisheries, Government of India pointed out that fundamental issue is the lack of understanding of the concept of insurance amongst the stakeholders and suggested that necessary outreach and capacity building programmes should be undertaken to build trust to attract private and other global insurance players to the fisheries sector. He highlighted that most of the stakeholders who demand insurance policies are from the marine sector and briefed about the Group Accident Insurance Scheme (GAIS) provided by the Department of Fisheries, Government of India. He concluded his address by stating that necessary legislative provisions may be incorporated in the Marine Fisheries Regulation Acts (MFRAs) as a first step to gradually enhance the adoption of fisheries insurance.

Shri Sagar Mehra, Joint Secretary highlighted coverage of capture fisheries insurance and aquaculture insurance policies adopted across various countries in Asia, Africa, Europe and Americas for industrial and smaller fishing vessels and large aquaculture operations etc.. He further mentioned about the insurance products available in the domestic market offered by insurance companies. He also mentioned about the challenges in the aquaculture insurance and strategy to expand the coverage of insurance in fisheries sector while taking advantage of technology, ICT/IT, remote sensing and mobilizing participation of various different stakeholders.



Dr L.N. Murthy, Senior Executive Director, NFDB delivers presentation on "Insurance Needs in Fisheries Sector".



B.K. Sinha, Chief Manager, Oriental Insurance Company Ltd, delivers presentation on topic "Aquaculture (Shrimp and Prawn) Insurance Policy"

During the technical session, Dr Shinoj Parappurathu, Senior Scientist, ICAR-CMFRI, Kochi, delivered a presentation on "Fisheries and Aquaculture Insurance in India: Opportunities and Challenges". He highlighted the common perils in the fisheries sector both in the inland and marine sectors and informed about the insurance policy/product presently available with government and private sector for fishing gears and other equipments. Further, he elaborately explained about the outcomes of the survey carried out by ICAR – Central Marine Fisheries Research Institute (CMFRI) that highlighted lack of familiarity of the insurance policies and products amongst fishermen community and the aquaculture farmers.

The above was subsequently followed by a presentation on "Insurance Needs in Fisheries Sector" by Dr. L.N. Murthy, Senior Executive Director, NFDB. He explained about the multiple opportunities of the sector and stressed upon the threats posed by the fishers and fisherfolks such as threats during fishing at sea, threats in culture practices etc. He explained about the insurance product developed which have proven to be beneficial for them. He also insisted upon the formulation of the insurance products by universities and academic institutions. In the end he quoted that, "Sustainability, Profitability and Productivity are the way forward" for the fisheries sector.

Later, Shri B.K. Sinha Chief Manager, M/s Oriental Insurance Company Ltd, New Delhi presented on the topic Aquaculture (Shrimp and Prawn) Insurance Policy. A detailed presentation was made on insurance products available for aquaculture of variety of species and the scope of insurance coverage of such products. He further shared information on the policy period, basic policy valuation and discounts that are offered to the beneficiaries. Towards the end, he concluded by quoting that suitable terms and conditions of the insurance policies of Oriental Insurance Company Ltd should be chalked out.

After the presentation, a Q&A session was held with the distinguished speakers, clarifications were sought from the distinguished speakers on practical and on-the- ground issues and possible actions and development of new insurance products.

First ever Emoinu Fish Festival organised to encourage fish farmers in Manipur

Hapta Kangjeibung, Manipur: Setting the target to make Manipur one of self-reliant state in fish production, directorate of Fisheries had organised first ever fish fair on Emoinu Eratpa Numit, a ritual ceremony of Meitei community in which fish are offered to Goddess Imoinu Ahongbi, goddess of wealth and prosperity on 3 January 2023.

The fair was named as Emoinu Fish Festival and held at Hapta Kangjeibung, Imphal East organised by department of Fishery.

It was participated by fish farmers from various districts of Manipur. As many as 90 fish stalls were opened selling varieties of fish including local or indigenous fishes.

Addressing the function as chief guest, minister of Fisheries, Heikham Dingo said that the state government has been conducting annual fish fair once in year since 1979 to encourage fish farmers of the state. The fair is being held one day before Ningol Chakouba Festivals, a traditional festival of Meitei.

With the advent of this present BJP government, special focus has been made to make Manipur a self-sustainable state in fish production. Under this vision, various steps have been taken up to achieve the vision. As a part of it fish fair will also be held every year on Emoinu Eratpa Numit, he informed while stating that this festival is to encourage fish farmers of the state to produce more fish and can make available fish at affordable rate.

He said that though fish is staple food of Manipur but

the state unable to meet the demand which has resulted to imported ice-packed fish from outside the state. Import of fish not only drained state's money but also created many health issues.

There is a great improvement in fish production. Under various scheme like Loktak Livelihood Mission, RKBY, Blue Revolution etc the state is trying very hard to meet the demand of fish in the state, he added and informed that even in today's fish fair, the state government had targeted to produce 50,000 kg of fishes.

It may be mentioned that the state government had already announced the price of various fishes. They are Catla with less than 2 kg will be sold at Rs 210, but if it is 2 kg and above, it will cost Rs 270 and Rs 350 for 5 kg and above. Sareng (Wallago attu) costs Rs 1200 per kilogram. Rs 450 for Pengba/Khabak (below 300 gm and Rs 550 for above 300 gm), Porom (Murrel) – Rs 350 per kg, Ukabi (Anabas) – Rs 350 per kg, Tunghanbi (Tilapia) – Rs 150 per kg. Ngaton – Rs 450 per kg.

This time, only 2,000 kg of Sareng and over 50,000 kg of fish will be available.

ICAR-CMFRI enters into an agreement with Emineotech to commercialize seaweed based liver health products

After signing in the MoU for the commercial production of CMFRI's product Cadalmin LivCure extract, Director Dr A Gopalakrishnan exchanges the licence agreement with Emineotech MD Evanjalist Pathrose.

ICAR- Central Marine Fisheries Research Institute (CMFRI) has entered into an MoU with Emineotech, a health products focused company, last week to commercialize a seaweed based liver health product. The managing director of Emineotech, Evanjalist Pathrose and Dr A. Gopalakrishnan, Director of CMFRI, executed the license agreement.

The ninth nutraceutical developed by the CMFRI is a one-of-a-kind blend of natural bioactive ingredients extracted from selected seaweeds. It is made using an environmentally friendly green technology to improve liver health.

In addition to boosting immunity, CMFRI has already made nutraceuticals to combat lifestyle diseases like type-2 diabetes, arthritis, cholesterol, hypertension, hypothyroidism and osteoporosis.

A patent-protected nutraceutical developed by the ICAR-Central Marine Fisheries Research Institute (CMFRI) from seaweeds to treat non-alcoholic fatty liver disease (NAFLD) is referred to as Cadalmin LivCure extract.

In a press release, CMFRI director Dr A. Gopalakrishnan stated, "We have been receiving an overwhelming response from the public ever since the CMFRI developed the Cadalmin LivCure extract, which shows increasing demand for natural remedies against lifestyle diseases".

He went on to say, "Commercialization of the product will be greatly beneficial to a large number of people suffering from non-alcoholic fatty liver disease because it helps improve liver health, reduce the disposition of fatty substances and maintain other liver/lipid parameters within the clinically acceptable limits." According to the findings of in-depth pre-clinical trials, the nutritional supplement does not cause any adverse effects.

He went on to say, "CMFRI launched efforts to the large-scale farming of seaweeds across the coastal states of the country, realizing the high pharmaceutical and medicinal potential of seaweeds".

The product's development research was led by Dr Kajal Chakraborty, the principal scientist at the CMFRI's marine biotechnology, fish nutrition and health division.

According to Pathrose, the product will be available for purchase online on Amazon, Flipkart and other leading e-commerce platforms within four months. It will also be sold in physical market networks across the country. He went on to say that the company would also launch programs to raise community awareness of the dangers of undiagnosed fatty liver disease and the advantages of natural treatments like changing one's lifestyle.

Work on modernisation of Kochi Fishing Harbour to be completed by this year end: Union Minister Dr L. Murugan

Kochi, Kerala: The Minister of State for Fisheries, Animal Husbandry and Dairying, Dr L. Murugan said on 3 January 2023, the work on the modernisation of the Kochi Fishing Harbour to bring it at par with international level, will be completed by this year end.

Speaking to media persons after visiting the Kochi Fishing Harbour, the Minister said, the tendering process has been completed and the contract work has been awarded for the 169 crore rupee scheme.

He said, the fish brought to the harbour will be transferred on conveyors to the auction hall, dressing area and then to the modern processing units, ensuring hygienic handling. The harbour will have dormitories, restaurants, washrooms and medical facilities for the benefit of the fishermen, he added.

Stating that the Union Government has earmarked 20,000 crore under the Pradhan Mantri Matsya Samapada Yojana for creating infrastructure in the fisheries sector, the Minister said, the focus is on developing fish landing centres, cold storages, ice factories and the modernisation of the fish markets. He pointed out that despite COVID, the country's marine products exports showed a 32 percent rise.

Earlier, the Minister held a review meeting on the progress of the Kochi Fishing Harbour project with people's representatives and officials of the Cochin Port Authority.

Dr L. Murugan, who is on a six-day visit to Kerala, is scheduled to visit Kodungallur in Thrissur district this evening and leave for New Delhi tomorrow.

STATE ACTION PLAN

FOR AQUACULTURE DEVELOPMENT IN ODISHA

ODISHA

I. Preface

Resources	Total Area(In lakh Ha.)
Freshwater	
Tanks/Ponds	1.33
Reservoirs	2.00
Lakes/Swamps/Bheels	1.80
Rivers/Canals	1.71
Brackishwater	
Area Suitable for culture	0.33
Back Water	0.08
Chilika Lake	0.79
Estuaries	2.98
Marine	
Coast line length of odisha	480 Km.

The state of Odisha is endowed with rich marine, brackishwater and fresh water resources and offers vast scope for development by judiciously harnessing these resources. The present production from marine fisheries sector is 1.80 lakh tons, shrimp aquaculture is 0.506 lakh tons and the total export earnings from the state during 2021-22 is USD 636.7 million (Rs. 4628 Cr.)

In Odisha, the production from Marine sector and Inland sector are largely consumed domestically and the contributions for exports from these two resources are negligible. The seafood exports are mainly supported by the Brackish water resources especially through the coastal shrimp farming sector.

There is ample scope for enhancing the production and export of marine products from the state through judicious utilization of potential

resources, policy interventions and infrastructure development.

II. Present Production and Export trend in the state:

A) Production trend:

	2019-20	2020-21	2021-22
Capture (Prodn in Lakh Tons)	1.58	1.75	1.80
Cultured Shrimp (Prodn in Tons)	48147	44555	50661

The production from Capture fisheries sector and shrimp production has shown an overall progressive trend during the last three years.

Trends in Capture fisheries

Compared to the national level production of approximately 35 Lakh tons from capture fisheries sector, Odisha's production is very less (1.80 lakh tons) though the state is endowed with a long coastal line.

A.2. Trends in Cultured shrimp production

The overall shrimp production from the country during 2021-2022 was 10.17 lakh tones and the state of Andhra Pradesh was the leading shrimp producer contributing to 7.887 lakh tones followed by Westbengal with 0.695 lakh tones and Gujarat with 0.60 lakh tones. Odisha stands fourth in shrimp production with 0.5066 lakh tones.

The district wise shrimp production from the state indicates that Balasore and Bhadrak districts top in the shrimp production in the state.

Sl. No	District	2019-20	2020-21	2021-22
1	Balasore	11521	11189	11573
2	Bhadrak	10320	8769	10839
3	Kendrapara	6680	6648	7685
4	Jagatsinghpur	11326	6382	8239
5	Puri	6451	6631	6956
6	Ganjam	1851	4936	5369
	Total	48148	44555	50661

The district wise production data showcases an equally important position of all coastal districts in Odisha in shrimp production. The availability and accessibility to hatcheries, feed mills and processing plants within the state and the neighbouring states have supported the positive growth of the sector in the state. Moreover, the untapped potential brackish water resources to the tune of an estimated area of 19600 Ha enhances the scope for further increase in aquaculture production.

B) Export facilities

The state has achieved a commendable growth in terms of the processing infrastructure facilities and the registered number of exporters, both manufacturer and merchant exporters. The decadal progress as evident in the below table keeps the position of Odisha in a very promising state, with stakeholders all along the seafood value chain available in the state.

PROCESSING INFRASTRUCTURE/ EXPORTERS				
2022	As 2000	As 2010	As 2020	As 2022
No. of Registered Exporters	1	20	55	53
No. of Processing Plants	7	19	32	34
Total Processing Capacity (MT/Day)	174	608	1257	1448
Storage Premises	12	20	33	37
Total Cold Storage Capacity (MT)	3630	12302	20130	24284
Fresh/Chilled Fish Handling Centre	0	0	2	2
Independent/ Common Ice Plant	0	1	4	4

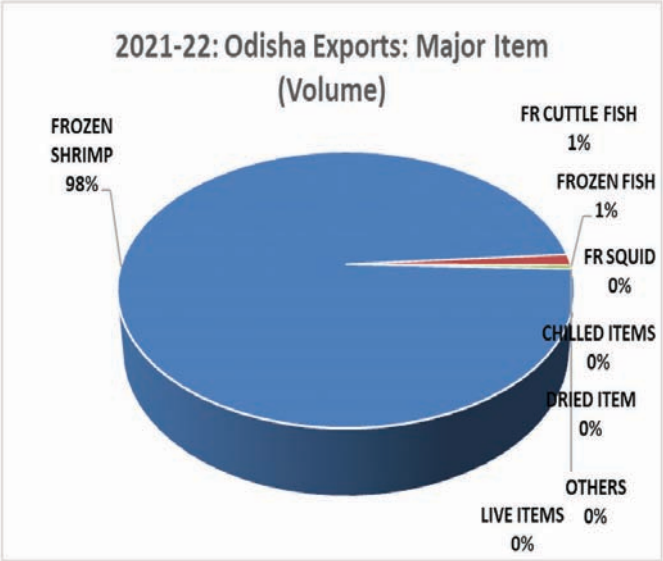
C) Export trend

The seafood export from India during 2021-22 was USD 7.76 Billion (Rs. 57586 Crore) and Andhra Pradesh stood first in exports with an export value of Rs. 20035 Cr. followed by Kerala Rs. 6971 Cr, Tamil Nadu Rs. 65590 Cr. and West Bengal Rs. 4742 Cr. The state of Odisha stood fifth in seafood export with a value of Rs. 4628 Crore (USD 636.37 Million).

The seafood export from the state has shown a steady increase over the past five years. The exports have shown a growth of 50 % and this indicates that the state is performing better in the seafood export sector and offers huge scope for enhancing further.

a. Item wise Exports:

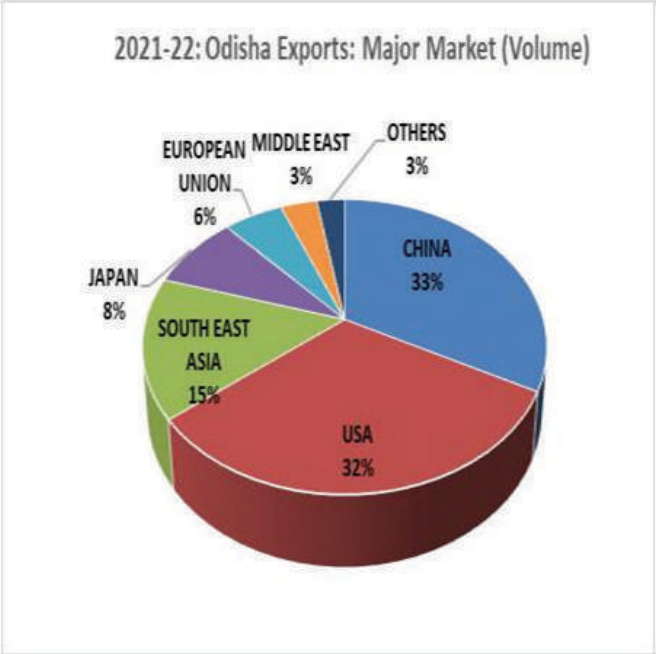
Frozen shrimp contributes maximum for the exports with total quatity of 85246 MT and hold a share of 98 % in quantity terms. Frozen cuttle fish and frozen fish contributes to the balance of 2%. In terms of value Frozen shrimp contributes 99 % of the exports contributing to USD 633 Million.

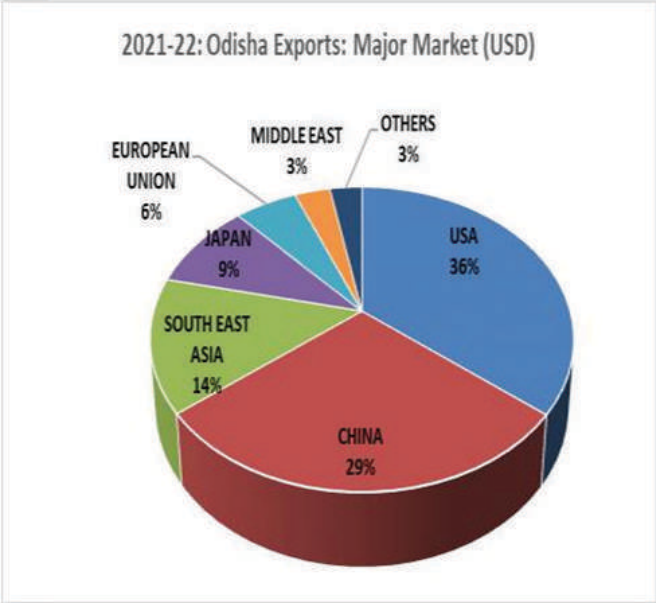


USD Mln	2021-22
FROZEN SHRIMP	633
FR CUTTLE FISH	3
FROZEN FISH	1

b. Market wise exports:

USA is the major destination of exports followed by China and South East Asia in value terms and China was the top market in terms of quantity terms sharing 33 % of the total export.





Quantity	Qty MT	USD (Mn)
CHINA	28358	227
USA	27422	183
SOUTH EAST ASIA	13397	90
JAPAN	7358	61
EUROPEAN UNION	4891	36
MIDDLE EAST	3031	21
OTHERS	2308	19

III. Major Market Access issues Faced in Export:

Sl. No.	Issues	Interventions
1.	Antibiotic usage in aquaculture (Market access issues in major markets like EU, Japan)	• Curtail the use of banned antibiotics such as Chloramphenicol and Nitrofurans in Aquaculture by joint effective monitoring of activities across the value chain through task force committee. • Promote Good Management Practices in Aquaculture
2.	Bio-Security (Presence of viruses like WSSV, IHHNV, IMNV are major market access issue in markets like China, Australia, Korea, Saudi, Thailand)	• Regulate all the farms in the state • Ensure proper biosecurity measures in place in farms • Promote cluster farming and promote Good Management Practices in Aquaculture. • Conduct awareness programmes to ensure adoption of bio-security measures and timely reporting of disease outbreaks • Ensure access to laboratory facilities to test seed, inputs, soil, water, culture species etc. Establish lab facilities in major farming areas and operate mobile labs
3.	Turtle Excluder Device (TED)- (US has banned export of wild caught shrimp from India due to non-implementation of TED)	State has notified inclusion of TED in OMFR Act. TED design will be finalized shortly once the visit of NOAA is completed in November State has to implement TED in all trawlers and ensure effective enforcement. Formation of Marine Enforcement wing will help in effective implementation of MFR Act provisions

IV. Best Practices adopted in Odisha in Fisheries Sector

The state of Odisha has adopted the following best practices:

a. Incorporated the mandatory provision TED in trawl nets.

b. Does not allow fishing during the turtle breeding season- November- in territorial waters,

c. Formed the Task Force on Antibiotic residue monitoring

d. Initiated the aquaculture diversification programme by taking up Tilapia & Seabass programme.

By adopting the best practices in other coastal states shall help in supporting the sector further

a. Formation of Marine Enforcement Wing as that of Kerala and Tamil Nadu

b. Upgradation of Fishing harbours as being done in Cochin Fisheries Harbour

c. Promotion of shrimp farming in Inland saline area/inland saline water as that of Andhra Pradesh

d. Providing cheap electricity for shrimp farming as that of Andhra Pradesh

V. Measures to Enhance production and Exports:

A. Marine Sector:

Infrastructure support:

- Fishing Vessel Cold Chain: The up-gradation of fishing vessels with cold chain facilities will reduce post-harvest losses, improve the quality of fish catch and increase the unit value realization of export.
- Upgradation of fishing harbours: A well-developed fishing harbor with good infrastructure facilities and professional management will help in better handling of catches to enhance the quality and unit value realization.

Policy intervention:

- Permitting Deep Sea Fishing by FPO/FPC The introduction of onboard processing vessels will help to exploit the untapped fishery resources of deep sea/high seas. The formation of FPO/FPC will help to run the vessels successfully and to protect the livelihood of the fishers.
- Formation of Marine Enforcement Wing & strict implementation of MFR Act: States like Kerala and Tamil Nadu have formed Marine Enforcement Wing and strict implementation of MFR Act will help in resource conservation, sustainable fishing and addressing trade barriers in trade.

Human resource development:

- Capacity Building & awareness campaigns: Conducting awareness/ training programme for fishers will improve the quality, food safety & sustainability in capture fisheries.

These interventions will help in reducing the post harvest losses, increasing unit value, resource conservation and addressing sustainability issues. This will lead to improving the livelilhood of fihsers, improving their socio economic condition and enhance the exports as well.

B. Culture Fisheries Sector:

Infrastructure support:

a) **Area Expansion:** The state has a potential shrimp farming area of 31600 Ha and the present area under shrimp culture is 12013 Ha. Effective intervention and support can help in bringing in remaining 19587 Ha under farming activity and this will enable increased production and exports. Coastal area mapping which has been done by Odisha Space Applications Centre (ORSAC) to promote brackish water aquaculture within the Coastal Regulation Zones (CRZ) and check un-authorized/illegal farming outside permissible CRZ can be used an effective reference tool for area expansion.

b) **Promotion of aquaparks:** and facilitating all basic facilities including road connectivity and electricity will also help in bringing in more area under aquaculture.

c) **Enhancing productivity:** The present productivity is 4.3 MT/Ha and can be enhanced to 7 MT/Ha by suitable interventions. This will help in increasing the production and export.

d) **Regular Desilting of creeks and canals:** and opening of bar mouth will help in ensuring good management practices in aquaculture to enhance productivity.

e) **Ban on use of antibiotics and ensuring biosecurity:** Effective enforcement of ban on use of antibiotics through task force committee and ensuring proper biosecurity measures will help in addressing the technical trade barriers being faced due to antibiotic residue issues and biosecurity issues.

f) **Better connectivity in farming area:** Enabling better accessibility to farming area by road connectivity and will help in maintaining quality of the harvested material and reduce the cost of production

g) **Providing electricity in farming area:** Providing electricity connectivity in the farming area will help in easy operation of the aerators and this will lead to increased productivity.

h) **Species Diversification:** At present the export is majorly depending on single species (L vannamei). Species diversification by promotion of culture of Indian black tiger shrimp, sea bass, GIF Tilapia and Scampi will help in increasing the production. The state Government has taken initiative in promoting these species by signing an MoU with MPEDA-RGCA for establishing hatcheries for black tiger shrimp, seabass and GIFT. Promotion of freshwater prawn (Scampi) culture with active support of CIFA, Bhubaneswar will help in enhancing production to support exports.

Policy intervention:

i) **Promotion of Cage farming in Inland water bodies and opea sea:** The state of Odisha has taken up initiative to promote cage farming with the support of World Fish. Large scale promotion of cage farming of fishes like GIFT and Seabass in Inland water bodies and sea cage farming of seabass & cobia will help in enhancing the production for exports.

j) **Promotion of vannamei farming in Inland saline area:** The state like Andhra Pradesh has enhanced its shrimp production and plays a major role in production and export by promotion of shrimp farming in inland saline waters. Like wise, Odisha can promote the farming by bringing out suitable guidelines.

C. Value Addition:

Promotion of Processing Infrastructure and Value Addition: The state of Odisha has established a seafood processing park at Deras. Promotion of value addition through enhancing the infrastructure and providing capacity building training will help in enhancing the unit value and export earnings from the state. This will also lead to higher employment generation in the state.

VI. Activities of MPEDA in the State

- Established a Regional office in Bhubaneshwar and promotes export oriented aquaculture and exports in the state
- Established a Quality control lab in Bhubaneshwar to ensure quality
- Operates ELISA labs to ensure antibiotic free shrimp supply
- Capacity building and assistance for value added product exports
- Market promotion through participation in international fairs along with exporters
- Preparation of Master Plan for Aqua Farms
- Promotion of export oriented diversified species through its society RGCA
- Promotion of Good Management Practices in Aquaculture through its society NaCSA
- Residue monitoring & control to address antibiotic residue in farmed shrimp
- Capturing of fish landing data to address traceability and facilitate catch certificate through its society NETFISH

VII. Way forward:

- The state has high potential to enhance production and exports. The state has already taken lot of proactive steps to increase the production.
- Implementation of the activities proposed shall further help in increasing production of quality raw material for enhancing the export.
- Modernisation of fishing harbours, improving the cold chain facilities in fishing boats and tapping of deep sea resources can help in increasing the production and unit value of the produce from marine sector. This will also ensure better employment oppurtunities, livelihood and enhance the socio economic status of the fishers
- Area expansion, increasing productivity, species diversification, promotion of cage farming, addressing antibiotic and bio security issues in aquaculture sector will help in increasing production. This will also enhance the income of farmers and ensure livelihood and nutritional security.

Annexure 1

FISHERIES RESOURCE IN ODISHA

Resources	Total Area(In lakh Ha.)
Freshwater	
Tanks/Ponds	1.33
Reservoirs	2.00
Lakes/Swamps/Bheels	1.80
Rivers/Canals	1.71
Brackishwater	
Area Suitable for culture	0.33
Back Water	0.08
Chilika Lake	0.79
Estuaries	2.98
Marine	
Coast line length of odisha	480 Km.
Continental shelf area (approx.)	24000 Sq.Km

District-wise Coastal Length (in Kms.)	
Balasore	80
Bhadrak	50
Kendrapada	68
Jagatsinghpur	67
Puri	155
Ganjam	60
Total Coastal length	**480**

PROCESSING INFRASTRUCTURE/ EXPORTERS	
No. of Registered Exporters	**53**
Merchant Exporters:	**21**
Manufacturer Exporters	**21**
Route Through Merchant Exporters	**11**
Total No of Plants	**34**
Total Processing Capacity	**1448.42 MT/Day**
No. of EU Plant	**19**
Cold Storage	**38**
Capacity	**23,049 MT**

Annexure 8

AREAS OF INTERVENTION TO ENHANCE PRODUCTION AND EXPORT

Sl. No.	Issues	Interventions	Impact
A	**AQUACULTURE SECTOR**		
a)	Area	Notify the potential aquaculture sites which were identified, surveyed, and plotted with the support of ORSAC	Result in speedy allotment ofpotential sites foraquaculture and ease the registration process
b)	Production	i. Electricity tariff may bemade on par with agriculture. ii. Providing infrastructuresuch as road, electricity in farming areas	Production cost will come down; productivity can beimproved
c)	Diversification	i. Setting up of hatcheriesand feed mills for diversified species ii. Formulation of open water leasing policy	Potential reservoirs andfarming sites can be utilized for culture of diverse species
d)	Hinterland	---"----	----"----
e)	Cage Farming	Formulation of open waterleasing policy	Potential reservoirs can beutilized for culture of diverse species

f)	Aqua Parks	Explore possibility of declaringSEZs	Stakeholders will benefitwith reduced capital and operational cost; Generationof employment; Increased exports; Successful models can be replicated
g)	Task Force Implementation	i. Regulation inspection visitsand testing of samples by Task force on a frequent basis. ii. Take penal action against farmers wherever conformed cases of contamination are reported under NRCP implemented by MPEDA	i. Curtail the use of banned antibiotic residues in aquaculture and production of safe aquaculture produce ii. Will reduce the rejections due to the presence of banned antibiotics in aquaculture shrimp in overseas markets. iii. Will enhance the quality of aquaculture products exported from the state and thereby increase market access
h)	Promotion of Cluster farming	i. Speedy registration of clusters ii. Active disease surveillance focused on clusters iii. Aqua one centres to be strengthened	i. Cluster based farming promotes sustainable aquaculture development ii. Declaration of disease free zone and reduce the incidence of disease outbreak
i)	Land lease policy	Speedy allotment of potential Government land for aquaculture	Entrepreneurs will benefit from the Government lease policy for brackish water areas
j)	Establish hatcheries for diversified species	Setting up of hatcheries and feed mills for diversified species	Potential reservoirs and farming sites can be utilized for culture of diverse species
k)	Dredging canals and opening bar mouths.	State may allocate funds for dredging of canals supplying water to shrimp farms and open up bar mouths on a regular basis.	Improved water circulation will result in enhanced production & reduced bio- security issues.
B	**MARINE SECTOR**		
a)	Fishing VesselCold Chain	Provide training to fishers on pre-cooling of catch, proper icing and storage in fishing vessels. MPEDA has submitted the proposal for the up-gradation ofinfrastructure facilities for maintaining the cold chain and to improve hygienic handlingonboard fishing vessels could reduce post-harvest losses and increase the unit valuerealization of export. Theproposal has been considered byDoF, GoI, and included in the scheme PMMSY under the component "Upgradation of existing fishing vessels for export Competency".	The up-gradation of fishing vessels with cold chain facilities will reduce post- harvest losses, improve the quality of fish catch and increase the unit value realization of export.

b)	Data Collection	Collect real time marine landing data from Paradeep, Dhmara, Balaramgadi, Bahabalapur and Balugaon. MPEDA deployed 100 HDC in major fishing harbors/landing centers for the collection of real-time landing data.	Real-time data collection is ensuring the traceability requirements of the importing countries and facilitates the issuance of catch certificates to EU and other countries
c)	Permitting Deep Sea Fishing by FPO/FPC	MPEDA conducted stake holders meeting on 06.07.2022 for the development of onboard processing vessels for fishing and processing on the High seas in order to tap the deep sea resources for export. The recommendation on the meeting was forwarded to DoF, GoI for suitable decision and implementation. MPEDA also provided the comments on Draft Guidelines for Regulation of Fishing by Indian Flagged Vessels in the High Seas, 2022 to DoF. The state may organise FPOs and assist under PMMSY for deep sea fishing, MPEDA- NETFISH will provide the technical support.	The introduction of onboard processing vessels will help to exploit the untapped fishery resources of deep sea/high seas. The formation of FPO/FPC will help to run the vessels successfully and to protect the livelihood of the fishers.
d)	Mesh Size regulation (MLS)	MLS to be notified by amending the MFRA Act.	Will improve sustainable fishing.
e)	Juvenile fishing	MFRA has to be amended to control the juvenile fishing. Marine enforcement wing under State Fisheries Dept. needs to be established as in Kerala and Tamilnadu for proper MFRA implementation.	Will improve sustainable fishing.
f)	Upgradation of Fishing Harbours for improving handling, hygiene and sanitation	MPEDA has submitted the proposal for modernization of the fishing harbour in India and identified 25 Major fishing harbours including Paradeep, Dhamra and Bahabalpur fishing harbour of Odisha state. The proposal has been considered by DoF, GoI and included in the scheme PMMSY under the component "Infrastructure and Post-harvest management - Development of fishing harbours and fish landing centres. Based on MPEDA intervention, Union Budget 2021 has announced Paradip fishing to develop as a hub of economic activity. The state has taken up the upgradation of Paradeep fishing harbour. May also take up the upgradation of Dhamra and Bahabalput harbours.	A well-developed fishing harbor with good infrastructure facilities and professional management will help in better handling of catches to enhance the quality and unit value realization. This will further enhance the livelihood opportunities for the fisher folk and help in the enhancement of export revenue

g)	Limiting fishing vessel engine capacity to 250HP	No regulation in MFRA. MFRA need to be amended in line with Kerala.	Will improve sustainable fishing.
h)	Monitoring, control and surveillance (MCS)	Vessel Monitoring System needs to be established by amending MFR Act for better MCS Based on the suggestion of MPEDA, DoF has considered the MCS under PMMSY State Fisheries Department, Odisha can approach DoF/NFDB for utilizing the scheme.	Two-way communication system (ISAT phone) will ensure the safety of fishers at sea and importing country's requirements.
C	**PROCESSING INFRASTRUCTURE**		
a)	Value Addition	During 2019-2022, MPEDA extended financial assistance of Rs.430.55 Lakhs to 6 beneficiaries under the scheme'Processing infrastructure andvalue addition'. In order to encourage value addition and increase the share of value added seafood export from the region, there isneed for financial assistance inthe sector.	Share of Value Addition Export from Odisha isplaced as **Annexure 6** Assistance for value addition infrastructure willlead to increase in export value and create more employment.
b)	Seafood Parks with basic facilities	Dedicated seafood parks needs to be developed which willboost value addition	The % share of valueaddition will increase
D.	**QUALITY ASSURANCE**		
a)	Labs (MobileLab)	State may bring mobile labs to test seed, feed and water quality for chemical and microbiological parameters in major aquaculture districts. Authorized technical personnel may be employed in these labs who will be able to guide the farmers on better management practices.	i. Provides lab services tothe door step of farmers,especially those who are small scale. ii. Helps farmer in periodical monitoring of his crop and seek technical advice. iii. Helps DoF to monitor the aquaculture activities thereby enhancing trade intelligence. iv. Improves crop quality, productivity and economic returns
b)	Mini Labs	During the year 2021-22 an amount of Rs. 1.5 lakh was released as Financial assistance for setting up of Mini Lab to one beneficiary from Odisha state. Since it is MPEDA scheme, no state intervention envisaged.	Better assurance of quality of seafood exported.

c)	PCR Labs	State may set up PCR labs in districts where most hatcheries are located to test seed quality before purchase and stocking by the farmers and also for disease diagnostics. Authorized technical personnel may be employed in these labs who will be able to guide the farmers on seed quality and farm / disease management.	1. Provides accessible lab services to the farmers. 2. Reduces crop loss due to poor seed quality and low survival / diseases. 3. Improves crop quality, productivity and economic returns
d)	ELISA Labs [MPEDA operates 2 ELISA labs in the state, one at Bhubaneswar and another at Balasore. During the year 2021-22 a total of 2389 samples were tested.]	1. State Government may encourage farmers to undertake Pre Harvest Test in MPEDA ELISA labs for every pond –wise crop during their training and extension activities. 2. State Government may consider subsidizing the PHT fees for farmers to popularize the concept among the farmers. 3. Take penal action against farmers wherever conformed cases of contamination are reported	1. Better screening of crops for banned antibiotics. 2. Better farm gate prices for farmers. 3. Reduces risk of rejections from overseas markets due to presence of residues of banned antibiotics, enhancing the confidence of exporters and importers on the products from the state. 4. Helps in creating a brand image for aquaculture products from the state.
E.	**CAPACITY BUILDING**		
a)	Awareness and Training	1. MPEDA conducts regular awareness programmes for fishersand other fishery stakeholders addressing fish qualitymanagement and conservation aspects to augment export. A total of 198 awareness programmes are scheduled for the year 2022-23 by NETFISH. State govt may fund NETFISH for conducting the awareness/training programmes. 2. State Government may train the farmers on Better Management Practices and post-harvest handling to improve the quality and productivity. 3. State may approve technicians for hatcheries and farms who are qualified and experienced enough to advise and administer aquaculture inputs and proper farm practices. 4. State may approve technicians / veterinarians who are qualified and experience enough prescribe medication in the event of clinical emergencies in hatcheries and farms.	1. Conducting awareness/training programme for fishers will improve the quality, food safety & sustainability in capture fisheries. 2. The intervention of unauthorized personnel in hatchery and pond management can be minimized / limited. 3. Provides documentation on prescription and usage of aquaculture inputs and medication. 4. Improves crop quality, productivity and economic returns. 5. Reduces rejections due to presence of residues of banned antibiotics, which improves market access and in building up a brand image for seafood from Odisha.

Annexure 9

Activities of Societies functioning under MPEDA

1) **RGCA:** Rajiv Gandhi Centre for Aquaculture (RGCA) a society under MPEDA promotes aquaculture diversification of export oriented species through technology transfer. Also provide consultancy and technical services, training to the entrepreneurs and farmers and undertake execution of Aquaculture projects entrusted by Government agencies.

   RGCA has signed an MOU with Department of Fisheries, Govt. of Odisha for establishing GIFT hatchery at Sampalpur and Seabass and P. monodon hatcheries at OSSPARC facility, Gopalpur-on-Sea.

2) **NETFISH:** Network for Fish Quality Management and Sustainable Fishing (NETFISH) is a society formed in 2006 under the aegis of Marine Products Export Development Authority (MPEDA), Kochi to empower fisheries sector by imparting knowledge to fishers, processing workers, technicians, other fishery stakeholders etc. on fish quality management, conservation of fish resources and sustainable fishing

   - Netfish conducts **Fishing harbor based awareness programmes, Dryfish development programme to improve the quality of the dryfish, paid training to workers** and supervisors of Seafood Processing units on good handling practices.
   - Under the MPEDA SC/ST welfare scheme, a total of **140 training programmes** will be conducted during 2022-23, including 100 landing
   - centre training programmes, 20 onboard handson training programmes and
   - 20 one week skill development training programmes supporting the SC fishers in Paradeep, Balaramgadi, Dhamara and Chilka area for capacity building.
   - In addition, an MOU will soon be executed by NETFISH with Chilka Development Authority (CDA) for executing a project on **"Empowerment of Traditional Fishermen Community under SC/ST Category for Livelihood Improvement,** under the MPEDA SC/ST welfare scheme.
   - Under the CIFT SCSP programme, 22 nos. of Harbour/ landing centre based **training programmes** will be conducted in Paradeep, Balaramgadi, Dhamara and Chilka area for the reduction of post-harvest loss, adoption of square mesh cod end and livelihood improvement.
   - Collect daily marine landing data from Paradeep, Dhamara, Balaramgadi, Bahabalapur and Balugaon on a real time basis through the **Harbour Data Collectors** in order to address the traceability issues.
   - Conducts Marine Mammal and Sea Turtle By-catch **surveys** by conducting fishers interviews at Paradeep, Dhmara, Balaramgadi, Bahabalapur and Balugaon, as part of the DoF funded project.

3. **NACSA**: NaCSA, a society under MPEDA promotes cluster farming and promotes better management practices (BMPs).

   - In Odisha NaCSA has **registered** 32 Aqua Farmers Welfare Societies with 1,071 farmers having water spread area of 606.57 Ha. Out of 32 societies, 11 societies received MPEDA permanent registration with 237 farmers, WSA of 190.98 hectares and 369 ponds. 03 Cooperative Societies have been organised for further registration with Functional Registrars.
   - NaCSA coordinated with RGCA officials in Odisha and facilitated in collection of 336 samples from the society farms for **Disease Surveillance** program and also assisted MPEDA officials in collection of 383 NRCP samples from the society farms.
   - In order to reduce the incidence of disease out breaks and to increase the production sustainably, NaCSA has established 03 Aqua One Centres (AOCs) in collaboration with MPEDA and NFDB to monitor the ponds of aqua farmers for water and animals' quality parameters regularly during culture.

Courtesy: *Raj Kumar Naik, Deputy Director, MPEDA, Odisha Region.*

Falcon aims to be No 1 Shrimp and Fish feed producer in Eastern India and capture 20-25% share in Indian shrimp feed market in the next 5 years

Falcon Marine Group aims to be No 1 Shrimp and Fish feed producer in Eastern India and capture 20-25% of Indian shrimp feed market share in the next 5 years, said the Director of Falcon Marine Exports Ltd Mrs Priyanka Mohanty. Priyanka is the Daughter-in-Law of Mr Tara Ranjan Patnaik. Aqua International Editor M.A. Nazeer had an exclusive interview with Mrs Priyanka Mohanty. Excerpts:

Mrs Priyanka Mohanty,
Director, Falcon Marine Group

Falcon Marine Exports Ltd has three divisions like Exports, Feeds (Falcon Feeds) and Retail (Falcon Chilika Fresh). They are also into Real Estate (Falcon Real Estate Pvt. Ltd.

Promoters:
Mr Tara Ranjan Patnaik
Mr Prava Ranjan Patnaik

Key persons of Falcon Group:
Chairman:
Mr Tara Ranjan Patnaik

Managing Director:
Mr Prava Ranjan Patnaik

Director:
Ms Priyanka Mohanty

Director:
Mr Parthajeet patnaik

Director:
Ms Adyasha Patnaik

Chief Operating Officer, Marine Division: **Mr P. Padmanabhan**

Chief Operating Officer, Feeds Division: **Mr Surajit Satpathy**

General Manager, Falcon Chilika Fresh: **Mr Swadesh Sarangi**

General Manager, Exports: **Mr Sailesh Patnaik**

General Manager, Feed Sales: **Mr G. S. Rath**

Born in Bhubaneswar, Odisha, Mrs Priyanka Mohanty did her B. Com, MBA (Finance + General Management from XIM, Bhubaneswar in 2008) and LLB. Her parents are Bani Prasad Mohanty, an Engineer and Pravati Mohanty and has two siblings. She joined Tata Steel as a Management trainee and got posted as the Executive Assistant to the Vice President (Odisha Project, Kalinga Nagar Project). In 2011, she joined Falcon Marine Exports Ltd in her father-in-law's business) and started taking training in finance and processing plants followed by being involved in expansion projects. She is also instrumental in introducing human resources policies and practices in the organisation.

Establishment of Falcon Feeds

In 2017, Falcon Feeds was established and she started looking into the purchases followed by production and finally the sales. Falcon has 20 dealers of feed and that too only in Odisha. Currently,

Tararanjan Patnaik and his son and daughter-in-law Parthajeet Patnaik and Priyanka.

they have a dealership network of 100 spread across the states of Odisha, Andhra Pradesh, West Bengal, Gujarat and Maharashtra. They also have a humble share in export to Bangladesh. Falcon Feeds started only one product i.e. Premium Vannamei Feed and today it has Vannamei feed, premium Black Tiger feed and Floating Fish feed in its product basket. The company has grown by 100 percent in the last 5 years.

1. Plant location: Jayamangalpur in Khurda district of Odisha.
2. Head Quarter: Bhubaneswar, Odisha.
3. Premium Vannamei Feed: Falcon Feeds

   Premium Black Tiger Feed: Falcon Feeds

   Fish Feed: Myrah

   1 – White Shrimp (L.Vannamei)

   2 – Tiger Shrimp (P.Monodon)

   3 – Fish Feed (Indian Major Carps / Tilapia / Pangasius)

Falcon produces following products in their feed units:

- Falcon Fresh Premium Vannamei Feed
- Falcon Fresh Premium Monodon Feed

Following Products are marketed by them

- Falcon Myrah Premium Floating Fish Feed
- Aqua Healthcare Products like Falminvit, Falcare PS, Faloxy, Falmag, Falpro, Fal Gutcare, Falzyme, Falmix etc.

Falcon has its R & D facilities in Odisha. They have their own farms in 4 different geographical locations in Odisha to conduct new research for ingredients and process. They also conduct field trials in culture areas in other states of India.

Falcon has its distributor network in pan India with major focus of sales is in Odisha, West Bengal, Andhra Pradesh and Gujarat markets.

Falcon Marine is exporting Tiger (P. Monodon) feed to Bangladesh.

Sales & technical services available exclusively in areas they have dealer / farmer network. They have a sales team of 40 Sales Executives and 4 Regional Heads and 1 Sales Head. All the sales and regional heads have fisheries background with good sales and farm service experience in feed business.

Falcon has 100 plus dealers network: Odisha – 50 Nos, Andhra Pradesh – 40 Nos, West Bengal – 4 Nos, Gujarat – 3 Nos ,Bangladesh – 1 No.

Falcon Fresh (Brand for our feeds) feed has established itself as a high quality premium feed which is a wholesale meal for the survival and optimal growth of the species.

Since it started in 2017, the feed quality has been upgraded with time. Some farmers also taken some trials of their own. All customers are happy as they are seeing their farm is harvesting gold with good FCR.

Prava Ranjan Patnaik and his daughter Adyasha Patnaik.

We follow the general aquaculture standards for shrimp and fish culture. Our products are designed to fulfill the optimum requirement of species culture in all aspects with considering sustainability of aquaculture in India, said Mrs Priyanka.

Our Shrimp feed sales Volume is 50,000 MT 60 % of sales is in Odisha market, rest all out of Odisha. We have 1.5% market share in Andhra Pradesh and Bangladesh export contributes 1,000 Mt annually.

Sitting from left: Brothers and their families - Mrs and Mr Tararanjan Patnaik, Mrs & Mr Prava Ranjan Patnaik; (standing from left) Priyanka, Parthajeet Patnaik and his sisters Ms Adyasha Patnaik and Ms Anisha.

India's shrimp Feed market size is estimated to be 13 lakh Mt during 2022, Falcon Feed contributes 4 % market share, she stated.

Priyanka told, as we discussed major part of our sales is in Odisha market (60%) which is 35% of Odisha shrimp feed market share. Our farmers get an advantage of Fresh feed usage which reaches to them within 24 hrs of production and get an advantage of low FCR. We are one of the early starters of pelleted feed in Starter grade feed (FF 2 – 1MM Pellets), this controls wastage of feed in early stage of culture and reduce pond pollution and less size variation in culture.

"We ensure that our customers are supported with best quality feed, quality after sales service and best price support for buy back shrimp"

- Aquaculture knowledge empowerment to farmer
- Recognizing customer feedback for providing right solution
- Aqua industry will survive and sustain by the growth of farmers only. All industry stakeholders should understand this reality
- Aqua feed millers, processors, aqua stakeholders, policymakers should make a common platform to discuss and implement present policies and future of growth and sustainability.

Best Practices

We follow BAP and CAA approved guidelines to follow during production and distribution of feed to our customers. For quality service to our customers, our executives visit every customer once in a week and periodically check their pond water and shrimp quality with the support of test kits and lab services. We maintain in a data bank for all our customers through mobile app service which helps us in maintaining traceability during product export. We have our own AHCP to support our farmers to harvest a profitable culture. For fresh recruited Executives we train them in our own culture farms to get updated knowledge in shrimp culture to give quality service to customers.

Priyanka with her children.

Mrs Priyanka Mohanty

To my view, Shrimp feed milling plays a prominent role in the development of Aquaculture industry in the last 3 Decades in India. A balanced formulated and well processed feed always results in better shrimp production and minimum loss to the farmer.

Present industry challenges like Quality of seed. Low production cost can only be supported by a well balanced formulated feed manufactured under a good process plan and well maintained factory conditions.

As per my belief, Feed millers don't adulterate feed. Because Adulteration will lead to spoil their business as well as name in this countable feed millers list. Again CAA, MPEDA, EIA, BAP, ASC, ISO like bodies are governing all the feed millers for restricting the use of harmful chemicals and antibiotics in feed manufacturing.

Falcon Group has presence in most of the areas in the aquaculture value chain, from farming to feedmilling to processing and exports to domestic retail. Now we are planning to get into other Agri processing sectors also.

With great power comes, greater responsibility. The industry relies on organisation like our's to grow and thrive. Hence its also our responsibility to push sustainable aquaculture in the state and country and to create awareness towards cost effective ways of farming for greater competitiveness in the market.

Parthajeet Patnaik with his father Tararanjan Patnaik and paternal uncle Prava Ranjan Patnaik.

We aim to be No 1 in Shrimp & Fish feed producer in Eastern India and capture 20 -25% of Indian shrimp feed market share in next 5 years. We ensure our customers to be supported by best quality feed, quality after sales service and best price support for buy back shrimp.

To all the stakeholders of the aquaculture community, I have this message that focus should be on long term sustainable aquaculture, so that we as an exporting

country should be able to compete with other global players in delivering competitive products for years to come. At the same time efforts should be made by multiple stakeholders to promote seafood consumption in the country which will bring stability to the industry, which is now completely dependent on the international market and its ever changing dynamics.

INDUSTRY OUTLOOK present and future

Presently the Indian aquaculture industry is at a stagnant stage due to increased global supply and marginally low demands. It is facing major competition from South American country of Ecuador. Higher value addition and exploring new countries as markets can only lead to growth of the country in this sector. In addition, for longer term sustainability of the industry, efforts should be focused on enhancing domestic consumption of prawns.

Parthajeet Patnaik and Priyanka with their children

Future plans of Falcon Group

In Aquaculture: Building up capacity of processing and exports by having two more plants, one in Andhra Pradesh and another in Odisha.

In Feeds: Already started fish feed, and getting into Petfood in the coming year.

Other businesses: Venturing into other Agri processing business, and beginning with French Fries. Planning to foray into speciality chemicals in the coming years.

Aquaculture Employees Association for the welfare of Employees in Odisha

Balasore: Aquaculture Employees Association (ACEA), Odisha was established in 2018 with its working Head Quarter at Balasore, Odisha. The Association has 250 plus members, out of which 17 members are officially registered.

Objectives of ACEA:

ACEA is a non-political, non-commercial, and non-profitable, but a voluntary and charitable organization having objectives as follows:

1. Welfare and safety of employees working in Aquaculture business sector in the district of Balasore and in the territory of Odisha.
2. To impart Technical Training / Camp / Seminar / Symposium relating to Aquaculture and Aqua farmers.
3. Technical upgradation of Aqua employees of Odisha state.
4. To create fund, to receive deposits on interest and to lend the same to members at concessional rate of interest.
5. To adopt other measures designed to encourage among the members, the spirit and practice of thrift, mutual co-operation, self-help and to propagate co-operative ideas.
6. To amalgamate with other society or societies, organizations or institutions in pursuit of all or any of its objects.
7. To print and publish Books, Magazines, Souvenir, Literature and Journals written by its members / writers.
8. The organization shall aware youth to undertake proper education which will succeed them for Aquaculture related job in future and jobs for others can be created.
9. The organization shall reach at doors of the sufferings during natural calamity and render necessary assistance to the local authority as and when required.
10. And generally, to do all such acts, deeds and things as are incidental to attainment of aims and objects of the society.

Below are the Office Bearers of Aquaculture Employees Association in Odisha.

President:
Mr Kamalakanta Das

Vice-President:
Mr Santosh Ku Swain

Secretary:
Mr Arabinda Ray

Asst. Secretary:
Mr Deba Prakash Rout

Joint Secretary:
Mr Karunakar Hota

Treasurer:
Mr Biren Ku. Mahapatra

Chief Coordinator:
Mr Deepak Ku. Pradhan

Snow World Marine targets Rs 500 cr turnover in Exports in 2023

Also deals with Sheng Long Shrimp Feed, and healthcare products of Meenam Aqua Needs, Inve, Salem Microbes and Sheng Long as the distributors

Snow World Marine Company has 13 investors & promoters and it is from to lead together. The farmers and the exporters should be honest enough to each other and grow, said Mr Prakash Kumar Mohanty, Managing Director, Snow World Marine Exports Pvt Ltd and Master Chef Exports.

Aqua International Editor M.A. Nazeer had an exclusive interview with Mr Prakash K. Mohanty. Excerpts:

Prakash Kumar Mohanty,
Managing Director,
Snow World Marine Exports Pvt Ltd

Born in Rajgangpur, Sundergarh, Odisha, Mr Prakash Kumar Mohanty did his Bachelor of Commerce and then worked for 25 years in Aquaculture sector before starting the company. Snow World Marine Exports Pvt Ltd and Master Chef Exports in Balasore, Odisha.

His spouse is running her own Boutique and has two Children - Daughter pursuing Masters in event management in Dubai and Son pursuing Masters in BBA in London.

Snow World Marine Partners / Promoters:

- Mr Bhibhuti Bhushan Mishra
- Mr Prakash Kumar Mohanty
- Mr Nandyala Ramakrishnam Raju
- Mr Lakamasani Satyanarayana
- Mr Kodali Rajendra Prasad
- Mr Kunaparaju Surya Subbaraju
- Mr Saroj Kumar Ray
- Mr Chinmay Kanti Biswal
- Mr Debasis Das
- Mr Sanjib Kumar Nayak
- Mr Gyan Babu and Debasis Das
- Mr Rabi Narayana Panda
- Mr Chandhan Maity

Master Chef Exports Partners

Mr Bhibhuti Bhushan Mishra

Mr Prakash Kumar Mohanty

Snow World Marine was established on November 8, 2019 with a capacity of 100 tons per day Head on.

1 Cooker Iqf and 1 Raw Iqf with 1050 Kgs / Hour.

4 Plate Freezers with a capacity of 800 Kgs / Hour per machine.

The factory is located in Balasore along with Registered / Corporate Office.

Key persons of the company with designation:

Mr Prakash Kumar Mohanty
Managing Director

Mr Bhibhuti Bhushan Mishra
Chairman

Mr Rajendra Prasad Kodali
Director

Mr Sanjib Kumar Nayak
Director

Mr Teja Kodali
Director

Category of products processed and exported

Snow World Marine Exports Pvt Ltd mainly deals in processing of Litopenaeus Vannamei also known as shrimp. We export cooked and raw shrimp products in IQF and Block types.

We deal in Peeled & Deveined, Peeled & Undeveined, Easy Peel and Butterfly IQF products also.

From where do you buy shrimp material in India?

We mainly buy our shrimp raw material from Odisha, West Bengal and Andhra regions.

Production & processing units situated in India

We have only one production and processing factory situated in Remuna region of Balasore, Nilgiri Road, Odisha State. Last two years we were merchant exporters and from 2023 we are processing in our own factory in Balasore.

R & D facilities and results

Yes, we have a World class Lab with all the latest equipment to analyze the shrimp components and try to process and export it in the best possible way.

Shrimp Feed, Healthcare products

We supply Sheng Long shrimp Feed. Last year we have sold 12,000 Tons of Feed in West Bengal, Balasore and Dhamra in Odisha. We also supply medicines of Meenam Aqua Needs, Inve, Salem Microbes and Sheng Long. Last year we did 7 crores of medicine sales in West Bengal and Odisha States.

Where do you export your products?

We export our products to South Korea, Japan, Vietnam and China. From 2023, we will start exporting to Europe and Canada. From 2025, we will start our exports to USA.

Acceptance and satisfaction level of products from the buyers

We supply best quality product with all the best practices. All the buyers are very happy with us and also we are getting repeat orders from them.

Quality of products and services

We have all the latest imported machinery in refrigeration installed in our Factory which provide more cooling retention. Also, we have analyzed and declared all the critical points and made a HACCP manual which we strictly adhere to. Also, we follow Best Aquaculture Practices right from Procurement of raw material to finished product.

Positive and the best aspects of the company and the products

The best aspect of our factory is the imported machinery. The Dantech IQF machines are best in class with thermofin evaporators and DSI Plate freezers are also very efficient in cooling with which we can guarantee more quality product. Also we have huge processing and pre processing facility in the factory which aids us in processing material in safe manner. Our Lab also helps in delivery the product with best nutritional value.

Prakash Kumar Mohanty

Volume and Value of shrimp products exported annually

Last year we exported 2000 tons of finished products with a value of Rs 120 crores.

Best practices implemented for development

We have expertise of 20 years in the export line which aids in our company development.

International market trend for shrimp

Up to 2021 market was good, but 2022, global market has declined compared to past.

But we have faith that the market will develop.

Turning point in career which helped to do well and grow

I was working under Magnum Group since 25 years. In 2020, I thought of exporting from our own company. After serving for 25 years in Magnum dedicatedly, the successors of Magnum group did not respect me. That was the turning point in my life to bring our Export House. So, I invited dear and close friends to invest in Snow World Marine Exports Pvt Ltd.

So, now we are 13 investors in our company. The investors are from Andhra Pradesh, West Bengal and Odisha. This company is born to LEAD TOGETHER.

Motivation you to perform well in business

Some of my Colleagues and Exporter friends encouraged me to start a new venture.

Future plans and targets

Our target in export line is to achieve Rs 500 crores turnover in 2023. We have sufficient land near our factory to diversify other nature of business.

Besides Processing and Exports, other activities in Aquaculture sector

We are financing feed, seed and medicine to farmers and dealers directly and indirectly.

Message to farmers and other stakeholders

My message to famers is to be honest for us who is sincerely helping financially and morally. Message to exporters is that they should also treat the farmers in the same way and grow.

Hari Marine Group Expanding

We are organizing meetings to bring awareness among our customers for healthy and sustainable aquaculture practices. We want to grow and let our customers also grow. We should be honest in our business.
Aqua International Editor M.A. Nazeer had an interview with Mr Sangram Kumar Das. Excerpts:

Sangram Kumar Das,
Managing Director,
Hari Marine Group of Companies

Mr Sangram Kumar Das, Promoter and Managing Director of Hari Marine Group of Companies was born in O.T. Road, Balasore, Odisha and did his B.Com, LLB and MBA.

Hari Marine Group of Companies:

- Hari Marine Private Limited
- Hari Udyog Private Limited
- Hari Distributors Private Limited
- Hari Regency Private Limited
- S.R. Aqua Products
- Orissa Rubber Products
- Hari Motors Pvt Ltd.

Career growth in Aquaculture business:

(a)	Orissa Rubber Products	Partner	Since 1992
(b)	Lion's Club International	Member	Since 1992
(c)	S.R Aqua Products	Managing Partner	Since 1994
(d)	Hari Distributors Pvt Ltd.	Managing Director	Since 1999
(e)	Hari Motors Pvt Ltd.	Director	Since 2004
(f)	Hari Udyog private Ltd.	Managing Director	Since 2006
(g)	Hotel Regency Pvt.Ltd.	Managing Director	Since 2008
(h)	INTACH, Balasore Chapter	Co-Convener	Since 2010
(i)	Hari Marine Pvt Ltd.	Managing Director	Since 2016
(j)	The Seafood Exporter's Association of India, Odisha Region	Vice President	Since 2019
(k)	Balasore Art and Craft College	Secretary	July 2021
(l)	Balasore Chamber of Industries and Commerce	Secretary Exports	April 2022
(m)	Balasore Law College	Treasurer	April 2022

Distribution company and its progress:
Mr Sangram Kumar Das, started distribution company in 1992 and in the last 30 years they have branches all over and its Corporate office is situated at O.T. Road, Balasore, Odisha.

Category of products being distributed / supplied and area of Distributionship :

- In Orissa Rubber Products, we are manufacturing all types of rubber products which are used in vehicles and in ports. We are supplying the products all over India.
- In S.R Aqua Products, we are cultivating shrimps and sell them to near by companies for processing and export.
- In Hari Distributors Private Limited, we are trading all types of feeds and medicines for cultivating of shrimps.
- Hari Motors Pvt Ltd is a distributor of Honda two wheelers.
- In Hari Udyog Private Limited, we are manufacturing of PVC, MDPE, CPVC and HDPE pipes and fittings. We are selling our products all over India.
- Hari Regency Pvt Ltd is a hotel and restaurant.

Sangram Kumar Das receiving award from Bollywood actor Anil Kapoor

Contd on next page

Dilip Sahu achieves Rs 148 Cr turnover

We are going to expand our business and start a new processing plant for prawn export purpose and create a new employment opportunity as well, said Dilip Kumar Sahu, Director, Save Sea Food. Aqua International Editor M.A. Nazeer had an interview with Mr Dilip Kumar Sahu. Excerpts:

Dilip Kumar Sahu
Director, Save Sea Food

Mr Dillip Kumar Sahu, Proprietor, Save Sea Food, who did 10+2, established the company 05 January 1996 at his native place Nayapada Haldipada, Balasore district, Odisha.

He loves greenery and nature. As he has good knowledge of agriculture and prawn culture, he took up Prawn Culture Business as it also provides good employment opportunity at rural areas. He was also awarded for it by the Governor of Odisha.

Progress of your dealership:

Prawn culture is a seasonal business, but it gave very good strength to rural areas people. They are progressing day by day and i took it as my progress. I provide them feed and supplements which are from branded companies. With this my dealership business also in progress, said Dillip Kumar Sahu.

Dilip Sahu has three daughters and a son. My family and all my staff members worked hard and supported me in the business which has grown up well, he stated, **I** have no more branches and is operated from Balasore. I have sub-dealers area wise.

We supply feeds supplements and prawn medicines from Chandaneswar to Paradeep, I have the godown facility of 10,000 sq ft.

Company products distributor:

I have distributorship of CPF India Private Limited, Vijayanagram, Vizag, one of the most prestigious feeds and medicines manufacturing companies in India.

Service networks: Door to door supply and by road.

Our products acceptance level and services to the customers are very high, he stated.

Annual turnover of Save Sea Food for the financial year 2021 - 2022 is Rs **147.74 crores.**

Other activities

I am fully involved in Aquaculture business and my moto is to create employment for unemployment persons in rural areas. When I feel free time, I use it for social work and plantation work with the people who want to save the nature.

Company development

First we need people with good attitude, professionalism, patiency to serve the customers and I want to make a comprehensive plan implementation for my company development.

Career turning point / business grow - This is the most vulnerable point in life, the complete future of a person's life depends on this single point and its none other than the time of choosing career. Yes, this point is very crucial and need to be attended very carefully. One wrong step and may end up choosing a wrong options. Sometime I have faced lot of problems but never break my goal that can help me out, said Dilip Sahu.

Motivation / inspiration: Yes, I have attended lot of motivation meetings with successful businessmen on how to run business smoothly, but I have not inspired any one only believe my hard work and my dedicated staff.

Future plans & target:

We are going to expand our business and start a new processing plant for prawn export purpose and create a new employment as well.

Message to the farmers and stakeholders

I personally advise all the farmers and competitors not to break your goal and use the quality material, follow the commitment and ask the difficulties of the customers, then you would grow day by day, stated Dilip Sahu.

Contn from previous page: **Hari Marine Group Expanding**

- In Hari Marine Pvt Ltd, we are processing shrimps and export frozen shrimps all over world.

Distributor for

a) Hari Distributors Pvt Ltd is a distributor of CPF India Pvt Ltd.

b) Hari Motors is the distributor of Honda Two Wheelers.

Supply and service network:

(a) Export of frozen shrimps, supplying PVC, CPVC, HDPE and MDPE Pipe and Fittings and hotel and restaurant services. All our customers are satisfied with our products and services.

Contd on next page

Tusar Kanti Panda targets Rs 100 Cr Turnover

The turning point for me was the year 2013-14 where we made a good sum of profit because of Vannamei Culture. Go carefully as there is a global competition for shrimps, said Mr Tusar Kanti Panda, Director, Aquamed Pvt Ltd. Aqua International Editor M.A. Nazeer had an interview with Mr Tusar Kati Panda. Excerpts:

Tusar Kanti Panda,
Director, Aquamed Pvt Ltd

Balasore: Mr Tusar Kanti Panda, native of Balasore, Odisha did his B.Sc and MBA and started Aquamed Pvt Ltd in the year 1998. The growth in comparison to other business is not so fast. There is a flat growth.

Distribution

Mr Tusar Kanti Panda informed that he started distribution business in the year 2000. The progress is well. Due to low line area, growth in Odisha is little bit slower because of different types of problem like Flood, Cyclone and Diseases. We have branches all over Odisha.

We mainly supply products of Growel Feed and Feed Suppliments along with Avanti Feeds and Lime etc. We have our godown in Balasore town. The size of the godown is approximately 5,000 sq ft.

We are the distributors mainly for Growel Formulations Pvt Ltd and Growel Feeds Pvt Ltd. Our supply and service network is through dealers. We do not have retail store.

Acceptance level of products

We have well accepted products since the year 2,000 till date. There is a craze among the farmers for the products we distribute. The anuual turnover of our company is about Rs 30 to 40 crores.

Role of Nutrition, Healthcare Products

The healthcare products should be result oriented as per their specification mentioned on the product label itself, he stated.

Besides aquaculture products distribution, Aquamed Pvt Ltd is also in the business activity of procurement of shrimp and supply to the exporters.

Tusar Panda feels that a business organisation needs positive commitment for rendering services.

Vannamei Culture is the turning point

To a question Mr Tusar Panda said, the turning point for him was in the year 2013 -14 where we made a good sum of profit because of Vannamei Culture.

To another question, Tusar Panda stated that from some well wisher friends serving in the aquaculture industry last but not the least my guide is Mr M.V.N Seshachary, Managing Director, Growel Formulations Pvt. Ltd. He is a man of motivation and inspiration.

Future Plans and Targets

Mr Tusar Panda has plans and target to achieve a turnover of Rs 100 crores. He cautioned the farmers and stakeholders of the industry to "Go carefully as there is a global competition".

Contn from previous page: **Hari Marine Group Expanding**

Annual turnover:

	Name of the Company	Turn over in Lakhs
1.	Orissa Rubber Products	Rs 750
2.	S.R Aqua Products	Rs 259
3.	Hari Distributors Pvt Ltd	Rs 4446
4.	Hotel Regency Pvt.Ltd	Rs 89
5.	Hari Marine Pvt Ltd	Rs 8860
6.	Hari Motors Pvt Ltd	Rs 4541

Mr Sangram Kumar Das strongly felt that the stakeholders of aquaculture industry should not use Antibiotics in aquaculuture. There are so many health care products in my area. We are organizing meetings to bring awareness in our customers for healthy and sustainable aquaculture practices.

My father is the inspiration

To a question he said, we are growing and developed ourselves. Yes. I am being motivated and inspired by my father to perform well in my business.

Future plans and targets

Mr Sangram Kumar Das said, we want to grow and let our customers also grow. We should be honest in our business.

Sangram Kumar Das receiving Brands of Odisha award

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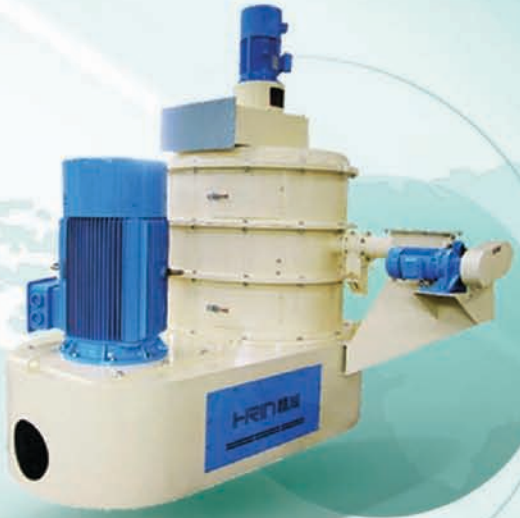

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Ultrasonic Wave against Pathogens in Aquaculture and its Various Applications in Fisheries

Email: anisha.aahpa901@cife.edu.in

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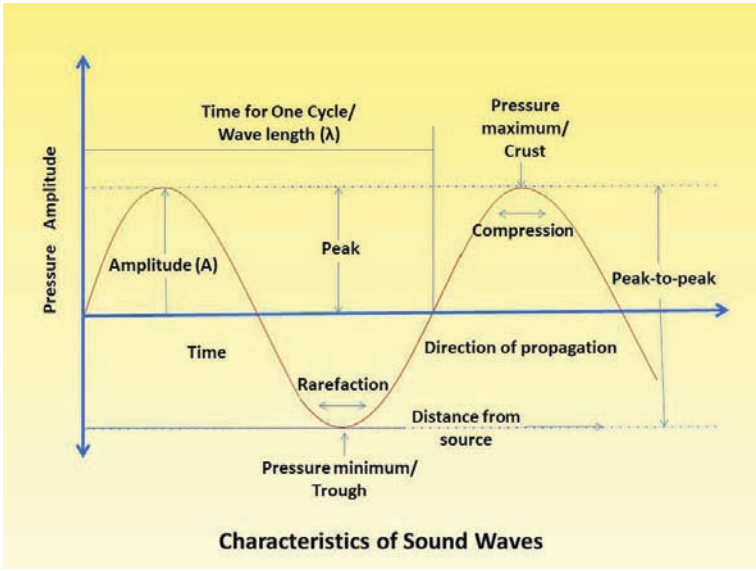
Highlight Points

- Ultrasound technology is an emerging field in commercial aquaculture having varieties of applications.
- The sonic wave of resonance frequency helps in the removal of pathogens, parasites and harmful algal blooms from the aquatic ecosystem.
- Sonic technology is an eco-friendly method targeting only the pathogen without seriously affecting the fishes in the culture environment.

Abstract

From time immemorial, the use of energy, frequency and vibrations have been put forth by many. But its many angles of utilities are yet to be explored; one such exploration is the application of sound waves to treat diseases by the destruction of pathogen or causative agent of the disease in the aquatic environment. The vibration of parasite cells or a microbe is the concept of destruction which is done utilizing the resonance frequency of the particular organism. Each organism's core frequency is called the resonance frequency at which the cells will vibrate in its nature. When this resonance frequency is applied to the particular organism, its cells break, resulting in death and this kind of technology is gaining importance in aquaculture, especially against sea lice infection of cultured cold water fishes. Although ultrasound technology has been successfully utilized in various fields, including medicine, its uses are not restricted. This article explains the applications of ultrasound and other sonic technologies in fisheries and aquaculture.



characteristics-of-sound- waves

Introduction

As aquaculture intensifies, complications associated with management also emerge. Thus, to reduce and prevent circumstances such as the occurrence of diseases, low water quality and harmful algal blooms, remedies are being

sorted out. Most of the therapeutics used as remedial measures for eliminating these dreadful situations are having their side effects in the culture organism. For this reason, the arrival of eco-friendly as well as the culture organism-friendly method is being welcomed. The application of ultrasonic waves in aquaculture is one among them. Even though sonic wave technology is applied in many branches of science, in aquaculture, it is a new advent which is expected to have a significant scope. More research is needed in this field against fish pathogens. Although the use of SONAR for marine fishing and navigation had started early, the core application of sound waves in other aspects of fisheries, aquaculture and fish processing is a lot. Such explorations can be achieved by combining the capacities of fisheries engineers and fisheries biologist. An integrated approach is needed in expanding the branch of acoustics in the aquaculture sector along with its already existing applications in marine fisheries.

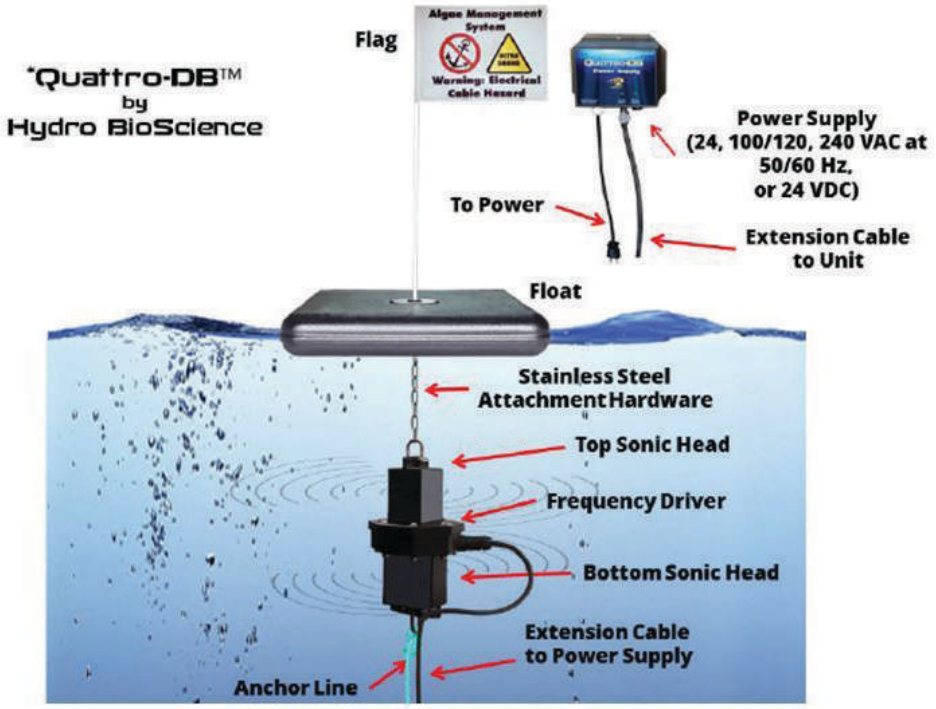


Illustration of Quattro DB ultrasound system

illustration-of-quattro-db-ultrasound-system

Technologies utilizing sound waves are used for various applications such as interior characterization, repulsion of insects, seismic imaging, audio data technology, acoustic tweezers, acoustic levitation, doppler ultrasonography (DUSG), scanning near-field ultrasound holography (SNFUH), and high intensity focused ultrasound (HIFU). Spectral ultrasound imaging (SUSI) is used for structural property and composition analysis of tissues in animals using sound waves. In the fisheries sector, sonic technology has been utilized for parasite control, pond algae control, extraction of lipids from microalgae, 'SONAR' for fishing and navigation, ocean floor mapping using interferometric synthetic aperture sonar, acoustic density estimation of dense fish shoals and sonophoresis for enhanced vaccine uptake. The ultrasonic treatment has been found to increase the yield of collagen extracted from the skin of fishes such as sea bass. Sonic wave technology has been shown to reduce the egg hatching time of marine fish. This technology also improves electricity generation in micro fuel cells. In the seaweed (*Gracilaria* sp) culture environment removal of fouling organisms and dirt from the algae is facilitated by sonic technology. Another important use of this technology is the ADDs (Acoustic Deterrent Devices), used for the avoidance of sea mammals in the fish cage culture provinces and alert for the presence of netting in the sea. Thus, sonic and ultrasonic methodologies are utilized in various aspects of fisheries and aquaculture.

What is an ultrasonic wave?

Sound is defined by Popper and Carlson (1998) as a density disturbance that propagates through a medium. 'Ultra' means high and 'sonic' denotes sound, which specifies the very high level of sound that's beyond the human hearing range and is above 20KHz. Naturally sound waves at this range are employed by some nocturnal creatures, marine animals, and insects. Examples include marine mammals such as whales, dolphins, orcas, porpoises and other animals such as bats, rodents and birds. This high-frequency sound wave is used in medicine to visualize the internal organs of the body or fetal imaging and this process is called as Sonography.

Usage principle

Though the ultrasound wave technology has various applications, utilizing it for pathogen removal in aquaculture systems is still not commercialized in India. Eliciting sound waves of any frequency without regulation in our area of interest will not ascertain the expected result. Finding out the resonant frequency is the fundamental principle of using the ultrasonic wave. For instance, consider targeting a pathogen or a parasite from a fish. The 'fish' and the 'pathogen attached along with the fish' are having different resonant frequencies. So targeting the pathogen needs only to find out its resonant frequency to solve the problem, which is quite tricky because of the uniqueness of the frequency from one organism to another. Once the resonant frequency is known, the other environmental factors affecting the process need to be addressed. Proper utilization of ultrasonic resonance frequency breaks the

cells of the pathogen resulting in its death. The spreading of energy using the sound wave over massive areas results in the reduction of the power per area, which is called 'geometric scattering'. Hence the area of treatment should be near the source of the ultrasonic wave generator for better results. As the sound wave propagates, some energy is absorbed depending on the temperature, pressure and salt content of the medium. The factors such as scattering, reflection and deflection contribute to the weakening of the sound wave as the wave propagates to a more considerable distance.

Other criteria needed for consideration is the medium in which sound wave is used. Typically sound waves travel fast and work fine in the liquid medium than air. Hence, net effect will be more in liquid medium than air. Also air can be considered as a significant barrier in the case of using an animal specimen for imaging using the ultrasonic wave. Usages of sonic wave need the consideration of several other factors which includes the variables such as frequency, intensity, beam dimension and duration for effective utilization.

Bacterial control

Pathogens in aquaculture include all the organisms which cause diseases comprising the bacteria, fungus, virus and parasites. For controlling the bacterial population, ultrasonic wave usage was demonstrated by Drakopoulou *et al*.,(2009) in which the deactivation of the gram-positive as well as the gram-negative bacteria was done at 24KHz. Utilizing this new approach, the bacterial population in the wastewater effluents in addition to aquaculture systems can be controlled. This approach provides the safe side of reducing the bacterial load, including the pathogens rather than using antibiotics. The usage of antibiotics once called the 'boom in medicine' is now losing its power because of antimicrobial resistance (AMR) occurrence among the pathogens. Also there are strict regulations for using antibiotics in aquaculture. Considering all this, the need for developing new techniques as remedies is essential in the case of pathogenic microbes which cause diseases. For this reason, the ultrasonic wave technology can be utilized since its use in the water system does not harm the fish under culture rather affects the target pathogen against which the frequency is used.

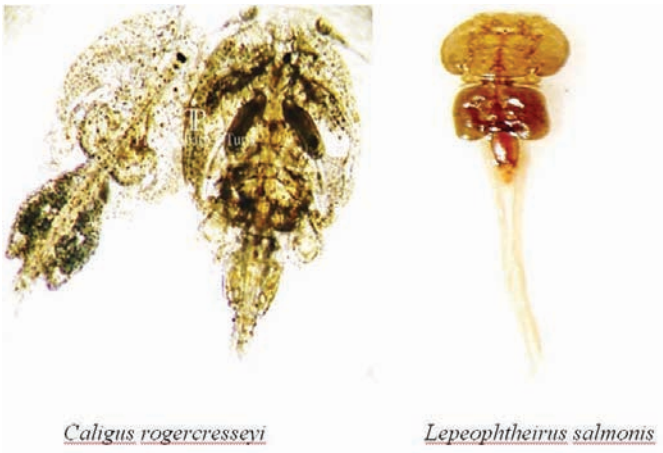
Reduction in the bacterial load occurs by using the pulsed sonicators of the resonant frequency. An increase in the power and treatment time results in the total coliform reduction in the water. Coliforms are considered as the indicators of faecal contamination in water and their presence is undesirable in the drinking water. But to use sonication in an economically-friendly manner, the power usage can be reduced by increasing the pulsation off duration. Also the bacterial load reduction was found to occur in log values among the bacterial species such as *Enterobacteraerogenes, Bacillus subtilis, Staphylococcusepidermidis*, with the use of ultrasound upon increasing the power. Besides the bacterium, *E. aerogenes* is found as more sensitive to the ultrasonic wave during its 'exponential growth stage', which is the faster multiplication stage of the bacteria. So this way of minimizing microorganism load can be done for yeast (*Aureobasidiumpullulans*) and bacteria that are present in the water. This inactivation is carried out by the production of free radicals and reactive oxygen species that damage the cell. The inactivation mechanism continues in the treated cells even after the sonication process is terminated. But there is a drawback in using this ultrasonic wave against capsulated bacteria as these bacteria are found to confer resistance to the sound wave. The capsules are external structures surrounding the bacteria comprising mucopolysaccharide which involve in various protective mechanisms of the bacteria. Hence, finding out the mechanism to disrupt the capsule of this kind of bacteria may aid in destruction.

Heckerman *et al.,* in 2010, have patented a system to disrupt pathogens using ultrasound. Wherein a computer-aided with the resonance frequency database of the pathogen is used to compare the average resonance frequency of the healthy cells surrounding the target material. But this ultrasound system is designed for treating targets in the cells and tissues of higher animals and not for application in the aquatic environment. However, this technique can be modified and adapted for the underwater system, for which invention is waiting to be made by the innovators.

Another approach of controlling the bacteria is combining the sonication with the traditional bacterial treatment process such as the use of antibiotics; wherein, the low dosage of the authorized antibacterial component is enough to act against the pathogen when used in combination with the quiet intensity sonication process. This process is useful against *Chlamydia*, planktonic bacteria and bacterial biofilms. The low-intensity sonication alone is not effective against bacteria unless it is combined with an even low dose of antibiotics.

Parasite control

In temperate aquaculture, salmon farming is a profit yielding industry in some countries such as Norway. But the occurrence of parasitic infection is a common phenomenon in the cage culture provinces of the salmon farming industry. Sea lice are the ectoparasitic copepods coming under the family 'Caligidae'. They are found attached to the skin, gill and fin of the fishes and feeds on the skin, mucous and blood of the fishes. The lice create wounds in the fishes in the feeding area, thereby allowing the secondary pathogens to invade inside the fish through the scars. For controlling this parasitic infection, various chemicals are used, including cypermethrin, emamectin benzoate, teflubenzuron, hydrogen peroxide, dichlorvos, azamethiphos pyrethrum. But the use of chemicals will result in environmental impacts and other side effects in the farmed fishes. Also, the chemicals result in high treatment costs due to repetitive treatments. The Norwegian Food Safety Authority has set an upper limit of 0.5 sexually mature female lice per salmon as an acceptable limit in fish farms. When the limit exceeds, the treatment must be initiated in the culture system.



Caligus rogercresseyi *Lepeophtheirus salmonis*

sea-lice

The Chilean sea lice (*Caligus rogercresseyi*) are the main parasite which corresponds to the loss of USD 300 million in the year 2009. This parasite is also found as a vector of transmitting Infectious Salmon Anaemia virus (ISA) among the fishes. Sea lice are attracted to light at the earlier life stage. By employing this strategy along with the sonic technology, a commercial sonicator is developed by a Chilean company called 'Usonic' which is created under CORFO (Chilean National agency of economic development). This technology results in a 30-50% reduction in sea lice load. The company 'Usonic Ltd' has got the Global Aquaculture Alliance's innovation award for its development of the method of controlling the sea lice in 2014.

Further, removal of salmon lice, *Lepeophtheirus salmonis* was tried in a small scale study in which the sound waves with the frequency of 9.3KHz elicit cavitation effects on the parasite along with the reduction in the parasitic load in the host animal. However, field application of ultrasonic waves for the removal of *Lepeophtheirus salmonis* is not assured. Thus the technology needs optimization for every kind and size of the target organism.

Steven Alevy in 2017 had patented a device for removing the sea lice from the atlantic salmon using ultrasonic waves. Wherein he designed a herding passage tube for salmon in which the transducers are fitted on the periphery of the tube. The tube is lined interiorly with stainless steel and exteriorly with the sound - absorbing material. This tube is used for removing sea lice from salmon during the normal herding process. Still, the method can also be employed in the cage cultured salmons wherein the fishes should be fed in an enclosure and white light should be used for attracting the parasitic sea lice along with the application of the ultrasound from the electronic sonicators which should be fitted at the inner periphery of the province. This method is encouraged in Indian cage culture systems for parasite removal.

Pond algae control

Nonchemical algal control measures are cheered in the aquaculture industry for which the sonic system is the best approach. It is a cost-effective approach and can be even utilized for larger ponds. The sonic technology can be applied for the eradication of harmful algal blooms caused by Cyanobacteria such as *Microcystis aerogenosa.* Algal cells contain small vacuoles of air inside for buoyancy which gets vibrated by the ultrasonic waves resulting in its damage. Vibrations damage the cell wall and result in the condensing of the cell contents at the centre of the cell by which the normal nutrient uptake is avoided. This method does not affect the fishes but can be employed for the control of geosmin in water since the microorganisms produce geosmin. Filamentous algae can be controlled, but the larger macrophytes such as 'chara' and 'duckweed' are resistant to the sonic waves. Algal coagulation removal can be improved by 12.4% when combined with ultrasonic treatment at 40KHz and 60W for 15s. Algal removal commercial sonicators are available in the market, for example, Quattro DB ultrasonic algae control system, Mezzo ultrasonic algae control system and ASMP ultrasonic sonic system. One of the ultrasonic algae and bio-organisms controlling apparatus is patented by Antonio Trigiani, U.S. This apparatus includes a power unit and a transducer that has a sonic head that can radiate from multiple angles. The frequencies used in this apparatus include the critical structural resonant frequency for each microorganism that is to be controlled.

Prevention of fouling:

The marine ships and the water inlet pipes are in continuous contact with the aquatic environment resulting in the provision of substrate for fouling organisms. Fouling poses a severe threat to the small diameter pipes as they clog the inlet or outlet system by the assemblage of the macrofauna such as the mussels. For the avoidance of fouling, ultrasound waves were investigated by some researchers in which pulses generated for every 45 seconds significantly reduced fouling by zebra mussel up to 23m from the transducer. Usage of 200 W power transducer and 17- 30 KHz frequency range resulted in a marked reduction in fouling near the transducer. However, there are only a few studies with little consistent reporting when it comes to the practical use of ultrasound on ships (Legg et al., 2015). The product USAF (Ultrasonic Anti Fouling System) is a commercial ultrasound-based system to prevent fouling on boats. The product is manufactured and marketed by Luykx Ultrasound2 in the Netherlands. The manufacturer claims that the transducer creates cavitation bubbles in the water in the immediate vicinity and when these bubbles collapse generate shock waves that "scare away" scavengers and other organisms.

Control and modification of fish behaviour

Fishes use the sense organs such as the ear (otolith) and the lateral line system for detecting the vibrations in the water. The man-made sounds affect the behaviour of the fishes. Utilizing acoustic signals, modification of the action of the fishes was tried at the laboratory. Limited success has been achieved in the experimental change of behaviour of clupeids *Alosa pseudoharengus* and American shad to prevent them from entering into turbine intakes at dams. Yellow perch (*Perca flavences*) and pumpkin seed (*Lepomis gibbosus*) adults were prevented from entering the inlet of the Nuclear Generation station using pneumatic poppers

(which doesn't use ultrasound). Some species of clupeids can detect ultrasound such as alosids. In a study at the Vernon hydroelectric station, ultrasound helps in moving fish away from turbine intake. The acoustic guidance system can be used for migrating fishes such as eels for preventing them from entering hazardous places. Hence, more understanding about the behaviour of fish against the ultrasound will help in the future for avoiding the fishes being entered into turbines and other inlet sources of commercial application.

Non-invasive method for inducing fish growth

The effects of sound on fish growth performance were evaluated on ornamental fishes which showed good growth results upon playing the binaural beat complexes for 90 - 270 min. The binaural beat treatment also showed high feed efficiency in fishes. The sonic waves having slightly different frequencies are called binaural beats with both the frequencies lower than 1500 Hz, with the difference between them less than 35 Hz. Hence, binaural beats can be used in aquaculture for enhanced fish production.

Acoustic telemetry tags

It is one of the tracking applications in fisheries utilizing sound waves. The labels are fitted with the fish and the fishes are released in the aquatic environment. 'Acoustic telemetry tags' emits sonic waves which help in the tracking and monitoring of the behaviour of the fishes. The acoustic tags emit pulses of signals which in turn are received by the hydrophone receiver. These tags are more useful in studying the biology of the fish species, which are mainly migrants. The different development stages of the fish can be tagged to check the migration of the organism during the particular period of its lifecycle. The activity and movement levels of American lobster*Homarus americanus* in natural habitatis quantified using ultrasonic telemetry in Canada. Similarly, this technique can be employed for tagging Indian migrant fishes and endangered species to study deeply about their life cycle.

Extraction from algae

Algae cells serve as a good source of lipid and various other components. Ultrasound technology helps in the extraction of lipids from the algal cells. Among the various methods utilized for algal lipid extraction, the 'Bligh and Dyer method' assisted by ultrasound was found to contain the highest yield from the algae *C. vulgaris* and is about 52.5% w/w. The various extraction processes from the macroalgae can also be improved with the combination of the ultrasound with the existing methods. The extraction of phycobiliproteins from the marine red macroalgae *Gelidium pusillum* was enhanced when the maceration of the algae is combined with the ultrasonication treatment. Usage of 300W ultrasound-assisted extraction (UAE) with the extraction time of 38.3 min was found to give the highest yield of taurine from *Porphyra yesoensis*.

For increased biogas production, sonic technology can be a powerful tool. At higher applied energy, the ultrasound treated cells show a higher rate of disintegration, resulting in increased biogas production. The ultrasound pre-treated *Hydrodictyon reticulatum* show increased biogas production by methane potential test than the non-treated one. Some other applications of ultrasound in fish processing technology include filtration, defoaming, depolymerization, drying, defrosting, freezing (by power-variable ultrasonic waves in saltwater immersion) and homogenization. Ultrasound treatment is found to accelerate the rehydration of dried sea cucumber in the processing industry. Thus various usage methods have been developed in the fish processing industry, enabling sonic technology.

Conclusion:

Ultrasonic technology is a promising alternative for therapeutics and antimicrobials. But the future extent of commercialization is not fully known even though the commercial algal control and sea lice removal equipment are available. Moreover, this technology does not harm the fish and has no negative effect and reduces the physical handling of the fish for parasite removal. It is an environment-friendly method, hence ecologically advantageous. Though the technology applies for parasite and pathogen removal, the other mentioned uses of the technology are not limited, and innovations can be made utilizing the principle of the technology. But more research is needed in this sector for field application in tropical countries like India. The research trials can be initiated in the cage culture provinces in India for effective parasite removal from the systems.

References can be provided on request.

SALINIZATION OF SOIL AND WATER

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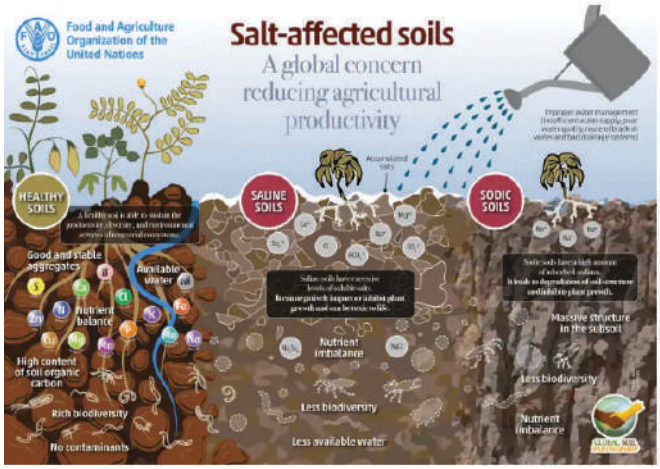
Introduction

What causes Salinization?

Salinization on the soil surface occurs where the following conditions occur together:

- The presence of soluble salts, such as sulfates of sodium, calcium and magnesium in the soil
- A high water table
- A high rate of evaporation
- Low annual rainfall
  - In semiarid areas, Salinization often occurs on the rims of depressions and edges of drainage ways, at the base of hillslopes and in flat, low-lying areas surrounding sloughs and shallow bodies of water.
  - These areas receive additional water from below the surface which evaporates and the salts are left behind on the soil surface.



Indicators of soil salinity

Early signs:

- Increased soil wetness in semiarid and arid areas
- The growth of salt-tolerant weeds
- Irregular patterns of crop growth and lack of plant

Advanced signs:

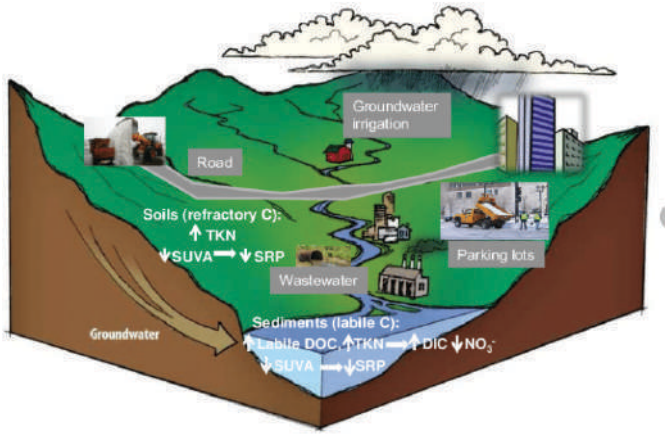
- White crusting on the surface
- Broken ring pattern of salts adjacent to a body of water
- White spots and streaks in the soil
- The presence of naturally growing salt-tolerant vegetation
- Soil salinity can be estimated by measuring the electrical conductivity of the soil solution

Highlight Points

- Salinization is the process by which water - soluble salts accumulate in the soil. Salinization is a resource concern because excess salts hinder the growth of crops by limiting their ability to take up water. Salinization may occur naturally or because of conditions resulting from management practices
- Any process that affects the soil-water balance may affect the movement and accumulation of salts in the soil. These processes include:
  - Hydrology
  - Climate
  - Irrigation
  - Drainage
  - Plant cover and rooting characteristics
  - Farming practices.

Effects of Salinization

- Salts in the soil increase the efforts by plant roots to take in water.
- High levels of salt in the soil have a similar effect as droughtiness by making water less available for uptake by plant roots.
- Few plants grow well on saline soils; therefore, Salinization often restricts options for cropping in a given land area.
- Salinization degrades the quality of shallow ground water and surface water resources such as ponds, sloughs and dugouts.



➢ **How can salinity problems be managed?**

- Reducing the severity and extent of soil salinity is primarily a problem of water management.
- Water management can be addressed in two ways:
  1. By managing the area contributing excess water to the soil.
  2. By managing the area where the excess water comes to the surface.

Recharge management

- Decrease excess water from infiltrating into the soil in recharge areas of seeps by diverting surface water to down slope ponds.
- Do not over irrigate.
- In some areas, over irrigation and the lack of natural drainage has raised the water tables, which may require the use of an artificial drainage system.
- Discharge of salty waters from these drains may contribute to other offsite problems.
- Irrigate to maintain salts at a level below the root zone in the soil.
- Use cropping and tillage systems that promote adequate infiltration and permeability.
- This includes building organic matter for soil aggregation and avoiding compaction.
- Plant crops that use the available soil moisture.
- Shallow rooted

Discharge Management:

- Grow salt-tolerant crops.
- Convert to permanent soil cover with salt-tolerant crops in high risk areas.
- Reduce deep tillage, which may bring up salts from deeper soil horizons.
- Plant forage crops or trees next to bodies of water to increase water use.
- Install artificial drainage systems in severely affected areas.
- Eliminate seepage from irrigation canals, dugouts and ponds.
- Generally, control measures should take an integrated approach involving cropping, structural methods and tillage systems.

Water salinity

❖ Water salinity is the amount of salt contained in the water.

❖ It is also called the "salt concentration" and may be expressed in grams of salt per litre of water (grams/ litre or g/l) or in milligrams per litre (which is the same as parts per million, p.p.m).

❖ However, the salinity of both water and soil is easily measured by means of an electrical device.

❖ It is then expressed in terms of electrical conductivity millimhos / cm or micromhos / cm.

Prevention of Salinization

Irrigation water quality

❖ The suitability of water for irrigation depends on the amount and the type of salt the irrigation water contains.

❖ The higher the salt concentration of the irrigation water, the greater risk of Salinization.

❖ The following Table gives an idea of the risk of Salinization:

Salt concentration of the irrigation water in g/l	Soil Salinization risk	Restriction on use
less than 0.5 g/l	no risk	no restriction on its use
0.5 - 2 g/l	slight to moderate risk	should be used with appropriate water management practices
more than 2 g/l	high risk	not generally advised for use unless consulted with specialists

➢ **Irrigation management and drainage**

❖ Irrigation systems are never fully efficient.

❖ Some water is always lost in canals and on the farmers' fields.

❖ Part of these seeps into the soil.

❖ While this will help leach salt out of the rootzone, it will also contribute to a rise of the water table; a high water table is risky because it may cause the salts to return to the rootzone.

❖ Therefore, both the water losses and the water table must be strictly controlled.

❖ This requires careful management of the irrigation system and a good subsurface drainage system.

Recirculating Aquaculture System (RAS): *A future technology of the Blue Revolution*

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Highlight Points

- The article is a practical discussion on the latest aquaculture technology that is RECIRCULATINGAQUACULTURESYSTEM (RAS), it includes the components, water quality, input requirements, Status of RAS in India, challenges and conclusion. This article is based on practical experience while working at ICAR - DCFR, Bhimal and discussed most of the things which are observed rather than copy pasting from some literature or article.

INTRODUCTION

The global capture fish production since last decade has stagnated at around 80 million metric ton (mmt). But at the same time the global fish production through aquaculture has increased from 101 mmt to 178.5 mmt, due to the adoption of new technologies and practices. Several aquaculture practices such as pond culture, cage culture, pen culture, bio-floc culture, flow-through culture, RAS (recirculatory aquaculture system), in–pond–raceway system (IPRS) are being used extensively, semi-intensively and intensively and also super-intensively to increase the overall fish production of the world. Among all the advance aquaculture technologies and practices, at present RAS (recirculatory aquaculture system) system is gaining most popularity and attention of people due to its sustainability and increased production. In RAS system aquatic animals can be cultured in fully or partially controlled conditions in higher densities with the reuse of fecal waste, ammonia, carbon dioxide and addition of oxygen. Depending on the filtration system the water recirculation efficiency in RAS system varies from 70 to 99.5%, where 70% in partially recirculatory system and 99.5% in case of completely circulatory system.

COMPONENTS OF RAS SYSTEM

The major components of RAS system includes:

- **Culture tanks:** Depending of the material used culture tank account for 20% to 40% of the total capital cost of RAS system. There are many tank materials available in the market such as FRP plastic, Concrete, Steel and HDPE etc. Most commonly used tank material for RAS is FRP, but for nursery operation plastic tanks can be used. Circular shaped tanks are mostly preferable for their excellent solid removal ability. But for farming of rainbow trout rectangular shaped tanks having the width of 2 m and length 10 to 15 m are widely used as it is space saving and easy to operate.
- **Solid removal system:** Faecal matter and uneaten feeds are the two main sources of solids in RAS. The specific gravity and particle size of the faecal material are important considerations when deciding which type of solid removal system to use. The main properties applied to remove the solids in water are gravity separation, filtration and flotation.
- **Biological filter:** In RAS, before the water is recirculated, the ammonia generated by the fish should be removed and for removing this ammonia, different nitrifying

bacteria are used, for which brown biofilter media play a key role. The main function of the biofilter is to provide a suitable and proper area and environment for these nitrifying bacteria. Different types of biofilters can be used as per requirements, such as a rotating biological contactor (RBC), a trickling filter, a submerged gravel bed filter, a moving bed bioreactor (MBBR), a flotation bed filter and a fluidized sand filter etc.

- **Degassing unit** (for removal of carbon dioxide): The source of carbon dioxide in the system is the respiration of fish and bacteria. The permissible safe limit of carbon dioxide is 20 mg/l. A carbon dioxide stripper or degasser is required when the standing biomass goes over 40 kg / m^3 and pure oxygen is used for maintaining the oxygen level.

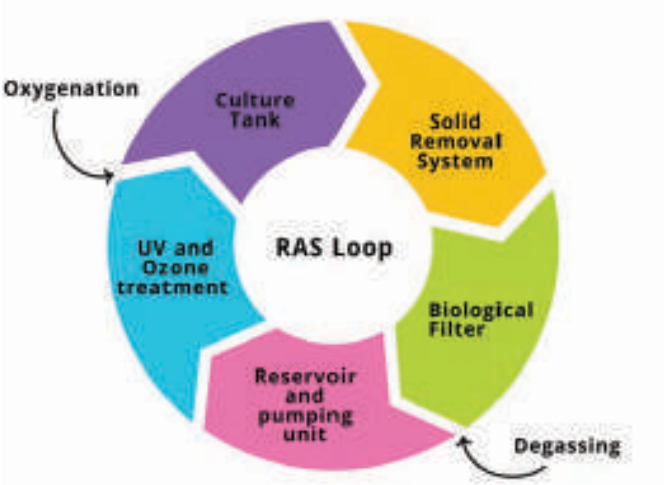

Figure 1; Major components of RAS

- **Water pumps:** A water pump is considered the heart of the RAS system as it moves filtered and oxygenated water from the filtration system to the fish and flushes the waste water from the culture tank to the filtration system.
- **Aeration and oxygenation:** Because oxygen is the most important limiting factor in the RAS system, aeration is required to raise the dissolve oxygen level. The three kinds of aerators mostly used in RAS are diaphragm blowers, ring blowers and root blowers.
- **Monitoring equipment, emergency systems and backups**: Because fish are cultured in high densities in the RAS, regular system monitoring is critical. Besides regular monitoring, one generator should be there as a power backup system to maintain all the operations without any interruption.
- Heating and cooling systems are required depending on the species to be cultured and the local climatic conditions

WATER QUALITY PARAMETERS AND WASTE MANAGEMENT

The ideal range of major water quality parameters for the RAS system for culturing tilapia and rainbow trout are listed in table 1 below:

Parameters	Rainbow trout	Tilapia
Temperature (°C)	12 -18	25-30
Dissolve oxygen (mg/l)	6-9	4-6
Ammonia (mg/l)	<0.02	<0.6
Alkalinity (mg/l)	50-300	50-300
pH	6.5-8.5	6.5-8.5
Hardness (mg/l)	50-300	50-300
Nitrite (mg/l)	<0.5 ;0.1(soft water)	<1
Chloride (mg/l)	>200	>200
Phosphorus (mg/l)	0.01-0.3	0.01-0.3

Table 1; Parameters required for cold and warm water fishes in RAS

The RAS-generated effluents and nitrate-rich water should be treated well before discharge into the natural water bodies. To reduce the nitrate and phosphorus levels, the effluents are generally discharged into a settling filter, followed by artificial wetlands. Effluents can be used as fertilizer in agricultural fields in the form of diluted slurry. The sludge from the effluents can also be removed through sludge thickening by using a belt filter, with or without flocculation. The sludge from the RAS can be used for biogas production.

INPUT REQUIREMENTS FOR RAS

For intensive farming of rainbow trout through RAS, the major inputs required are listed in table 2 below:

Species	Rainbow trout
Seed material, cost and availability	Eyed ova (Rs. 2 - 5 /-) & Fingerlings (20 /-) Source- Govt., Private hatchery and abroad.
Feed requirements	Require high quality feed Crude protein - 45 - 50% Crude lipid - 16 - 20% Cost of feed - Rs.130 - 180/kg FCR - 0.8 to 1.1 (with proper feed management)
HRT/flow rate	Minimum hydraulic retention time - < 30min (The tank water should be replaced twice in an hour to manage the water quality parameters in their optimum range)

Fresh water intake or exchange requirements	10 - 15% of the system volume can be exchanged daily basis.
Water requirement	700 to 800 lit/kg of rainbow trout
Energy requirement	8-16KWh/kg of rainbow trout
Total production cost of fish	Rs.250-280/- per kg fish
Selling price	Min. Rs. 600

Table 2; Input and output of RAS

STATUS OF RAS IN INDIA

In India, fish production through RAS has not yet gained much attention due to the high initial investment and lack of skilled labour. But commercial rainbow trout culture through RAS has gained popularity in recent time and in this regard, ICAR-DCFR (Directorate of Coldwater Fisheries Research) has been working for the last four years. To mitigate the problems associated with conventional trout farming, ICAR-DCFR has successfully designed and established a pilot project at Bhimtal, Uttarakhand, for the farming of rainbow trout through RAS. The production capacity of the project is 2 metric tons per year, but this system is mainly used for research and demonstration purposes. ICAR-DCFR has also designed, established and validated hatchery and nursery RAS for incubating trout eggs and rearing trout fry in different locations. ICAR-DCFR also successfully experimented with egg incubation and fingerling production, which can also be possible in adverse weather conditions in Ladakh through controlled RAS conditions. Currently, two commercial RAS-based rainbow trout farming facilities have been established in India, namely one at Awantipora in Kashmir with a system volume of 500 m^3 and a production capacity of 15 tons, and another at Hyderbad, Telangana, with a production capacity of 300 tons.

ADVANTAGES OF THE RAS SYSTEM

I. Through RAS, water usage can be reduced by 10 to 100 times.

II. The growth rate is very fast in RAS due to controlled conditions.

III. Through RAS, aquaculture activities can also be possible in areas where conventional fish farming is a challenging task due to the adverse climatic conditions.

IV. In RAS, the effluents are regularly treated, so eutrophication is not a problem.

V. The feed efficiency is higher in RAS.

VI. Resilient to weather and climatic change.

CHALLENGES

Though the fish production through RAS is higher than other conventional farming systems, farmers and hatchery owners are not readily adopting the RAS technology due to the high initial investment and lack of skilled labor. To develop a successful RAS facility, different backup systems are required, such as power backup, emergency oxygenation backup, and other vital equipment. In RAS, the payback period is also long. Apart from these, the other main reasons behind the failure of RAS technology are inadequate planning, poor system design, operational shortcomings and a lack of technical expertise. Another major challenge in RAS is the high energy requirements, which could vary from 5 to 20 kHw for every single kg of fish production. It is reported that 50% of the globally surveyed RAS system had to be rebuilt again due to poor initial planning.

CONCLUSION AND OPPORTUNITIES

Despite these challenges, RAS technology has grown steadily, primarily in EU countries. Due to rising land prices and water scarcity, people in Asian countries are increasingly adopting this technology. The Indian government, like governments in other countries, is promoting RAS technology among youth and farmers through various schemes and incentives. The environmental advantages of RAS could be another main reason for its increasing popularity, as RAS is considered a climate-smart aquaculture practice. Controlled and secure conditions for cultivating high-value fish are one of the most significant opportunities provided by RAS. By using RAS technology, fish can be cultured during the winter season. Furthermore, the development of simple and small-scale RAS with a reduced initial investment can be a game changer for quicker or wider adaptation of RAS for backward fish production in rural and semi-urban areas of developing countries.

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