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CIBANEWS

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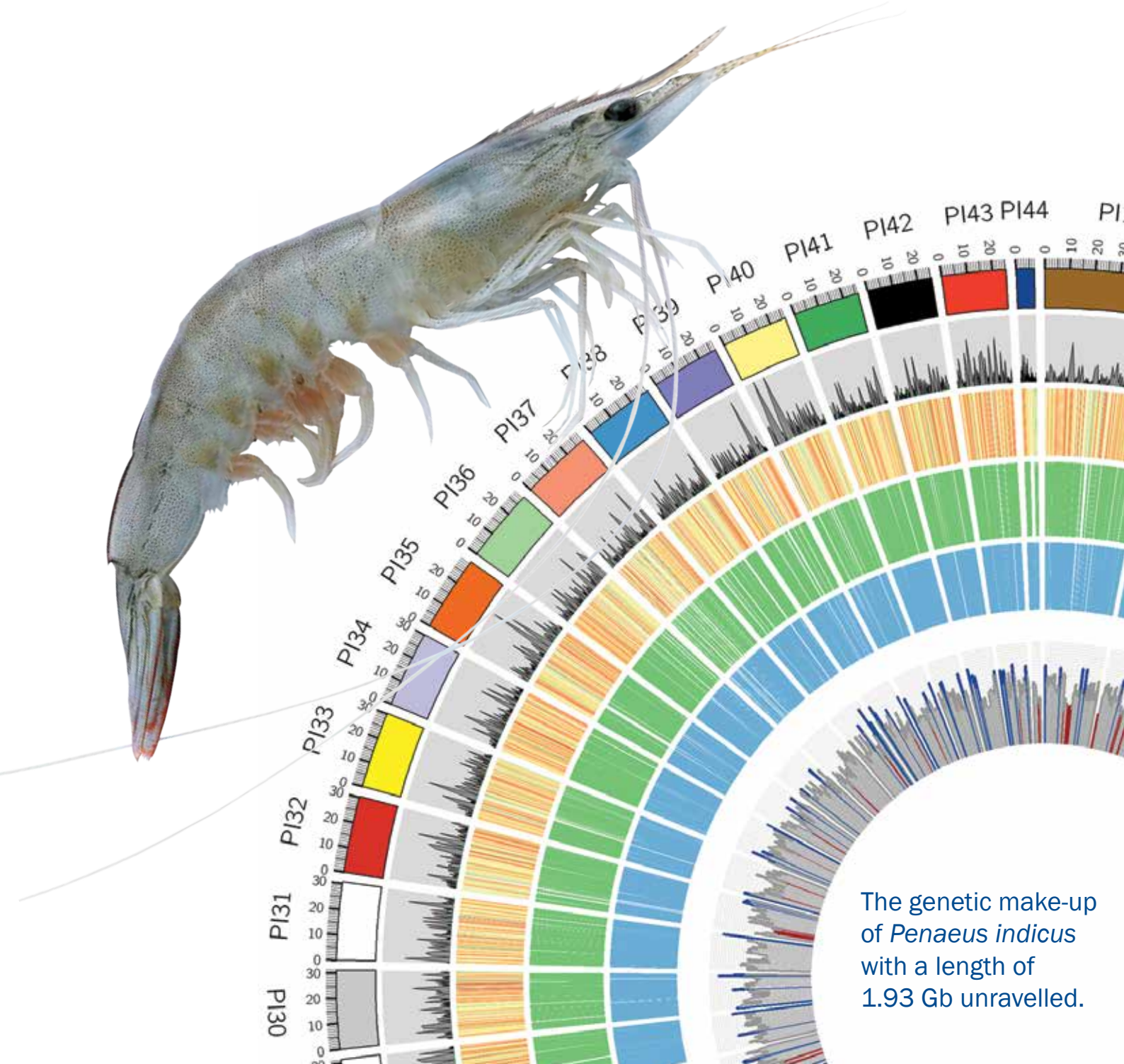

The genetic make-up of *Penaeus indicus* with a length of 1.93 Gb unravelled.

CIBANEWS

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ICAR-CIBA - a nodal R&D agency working in brackishwater aquaculture for the past three decades with a vision of environmentally sustainable, economically viable and socially acceptable seafood production. Technology backstopping and interventions by the institute is benefiting the sector to the tune of ₹ 10,000 crores annually.

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From the DIRECTOR'S DESK | Dr. K.K. Vijayan

We are in the 2nd spell of COVID-19 related lockdown restrictions in the country since April 2021, after this pandemic made its first wave from March 2020. Brackishwater aquaculture, like any other sector has been affected by the disruptions across the shrimp and fish supply chain. Our study in 2020 revealed that, COVID-19 and the related restrictions severely impacted the sector's entire value chain. However, it revived quickly and could survive, thanks to the timely interventions by the governments declaring fisheries and aquaculture as essential activities.

During this ongoing pandemic, CIBA have adapted ourselves to the new-normal situation and worked on all the possible modes starting from 4th May 2020, strictly adhering to the COVID-19 guidelines issued by the Government of India. We have prepared and posted advisories through digital media and conducted the first Digital Conference to discuss the impact of COVID-19 and the way forward during June 2020.

Using the virtual media tools, we conducted official meetings and about 30 trainings on various aspects of brackishwater aquaculture in the regional languages. We have produced inputs such as feeds and seeds with our R&D infrastructure available at our Muttukadu Experimental Station, Kakdwip and Navsari Research Centres and strived to back up our farmers and other stakeholders. To some farmers, we helped them to get their inputs. To some, we helped them to sell their produce by arranging logistics under challenging situations.

During this past year, we could sustain the functioning of the labs and our hatcheries at Muttukkadu experimental station, research centres in West Bengal and Gujarat. We were able to come out with some significant achievements like breeding of grey mullet (*Mugil cephalus*) and Mangrove red snapper (*Lutjanus argentimaculatus*), for the first time in the country, a breakthrough which was waited for the last 40 years. These two species can play a major role in driving the brackishwater aquaculture and contribute to the envisaged blue revolution in the country. Also, we commercialized the cutting edge technologies of 'Phage therapy for shrimp hatcheries, biofloc product, the 'CIBAFLOC', CIBA OXY^{Plus}- Dissolved Oxygen Enhancer and CIBA-Nodavac-R, Recombinant Viral Nervous Necrosis Vaccine *etc*. Recently we had a consultation meeting on developing a pragmatic crop insurance product for shrimp aquaculture to handhold the small and medium scale farmers.

After the nationwide demonstration of Indian white shrimp *P. indicus* farming as a complimentary desi option to exotic *P.vannamei*, the whole genome with a length of 1.93 Gb was deciphered, the 3rd shrimp genome after the *Penaeus vannamei* and *Penaeus monodon* genome from overseas labs. This would contribute significantly towards our effort in the flagship program on stock improvement and domestication of Indian white shrimp in the coming days. CIBA will continue its focus on technology backstopping initiatives in species diversification, formulated feeds, health management, stock improvement, social engineering, and livelihood development through prioritized R&D that would open up new avenues and increase confidence to the farmers and policymakers. This would provide new hope and direction for expanding the brackishwater aquaculture for increasing fish production, employment generation and economic benefits through the judicious utilization of the untapped resources.

During this challenging time, with our continued perseverance, CIBA acquired about 64 acres of land from the Salt Department, Ministry of Commerce and Industry, Govt. of India, located on the scenic East Coast Road at Kovalam. This land has access to estuarine/backwater/oceanic waters, which is ideal for developing diversified farming systems, brood & nursery banks, and fisheries-based livelihood systems. Our collective dream is that the Kovalam Experimental Station of CIBA would grow and strive to become a center of excellence in brackishwater aquaculture in South East Asia in the days to come. Besides, we could add new infrastructure facilities *viz.*, an eco-friendly bridge to the mini-island area at MES, state of the art Aquaclimate laboratory, brackishwater ornamental fish hatchery and finfish seed rearing unit, and Farmer Facilitation Centre. Similarly, additional laboratories, ponds and farmers hostel at KRC, and a sprawling 10 ha brackishwater farm, at Navsari, under the Navsari Research Centre of CIBA, from the Govt. of Gujarat was achieved during this period.

All these were possible through sincere efforts of "Team CIBA" with able guidance and support of Fisheries SMD at ICAR. My sincere appreciation and best wishes to every member of the 'CIBA family' for the achievements made, with their involvement and hard work even in these difficult times. We are submitting this issue to the readers, and confident that the newsletter experience would be a refreshing one.

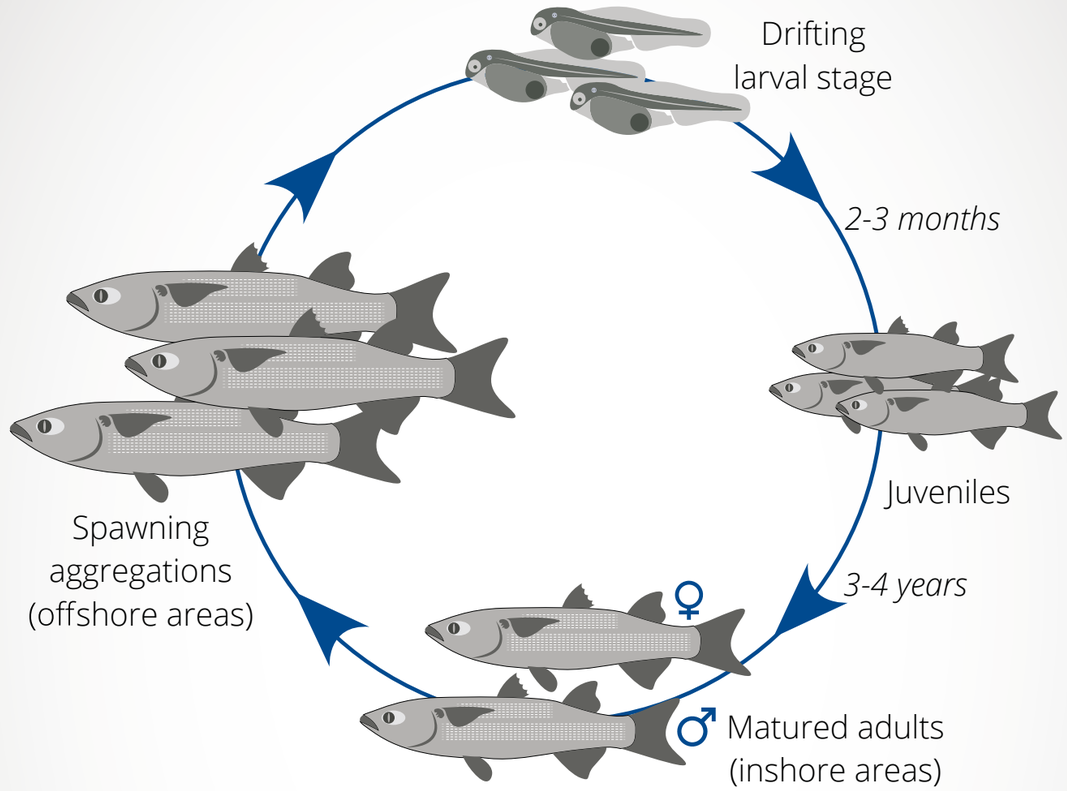
THE ENIGMA OF CAPTIVE REPRODUCTION OF GREY MULLET, *MUGIL CEPHALUS*

Grey mullet, *Mugil cephalus*, is the most desirable finfish species for brackishwater aquaculture with cosmopolitan distribution. Because of its euryhaline nature and herbivores feeding habit *M. cephalus* have been cultured for centuries in extensive traditional farms. Grey mullet is valued in aquaculture due to the relatively fast growth rates among the *Mugilid* species, high market value, and also due to its contribution to a healthy pond ecosystem. Most of the grey mullet production in different countries including India is reliant on wild seed for stocking in grow-out systems. Despite the first successful induced breeding of grey mullet reported as far back in the 1960s in Taiwan, only a few countries like Hawaii, Italy and Israel rely on a limited scale on seeds produced through artificial propagation.

It is important to understand that, despite many decades of research, grey mullet hatchery production is still on an experimental and semi-commercial scale as compared to the hatchery production technologies for fish species that were developed alongside or after grey mullet. Unlike most of the fish species that have a protracted reproductive period and are multiple spawners, grey mullet is a synchronous spawner and usually one clutch of oocytes matures annually. The maturation of oocytes is linked to a specific temperature and photoperiod regime and hence the annual reproductive period may often be very short. As compared to most brackishwater species, grey mullets exhibit high levels of dopaminergic inhibition which affects the maturity percentage and the success in final oocyte maturation. The captivity-related multiple reproductive dysfunctions observed in grey mullet like low percentage of spermiating males, asynchrony in male and female maturation are now ameliorated by exogenous hormone therapies.

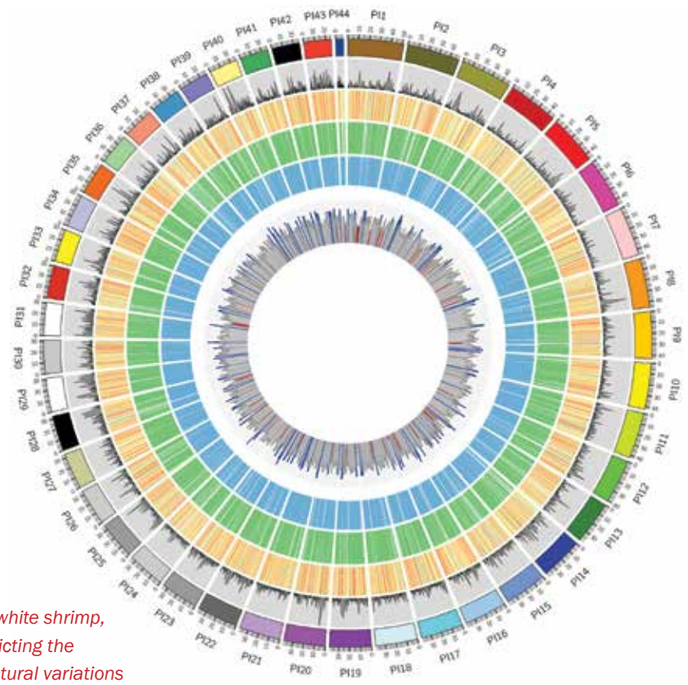
In India research on induced breeding of grey mullet from wild and captive populations was also initiated in tandem with global efforts. ICAR-CIBA has tried to utilise the asynchronous reproductive periods of grey mullets at the west and east coast during July and November, respectively in the past five years for seed production of grey mullet. At the west coast farm, reared grey mullets were induced bred using a low volume breeding system and at the east coast, broodstock reared in an RCC tank system were used for breeding trials after giving sustained hormone treatments. Currently, a fish maturation percentage over 80% is obtained using these hormone therapies. Induced breeding with both stripping and natural spawning is standardised and an average larval survival of 22% has been reached. These methods are being improvised and further scaling up of fry production is targeted in the coming years. Although considerable research progress for captive seed production of grey mullet has already been made, further scientific efforts to resolve the challenges in captive grey mullet reproduction especially for controlling its reproductive cycle still remain.

LIFE STAGES OF GREY MULLET



A collection of grey mullet fingerlings from the nursery pond

ICAR-CIBA ACHIEVED BREAKTHROUGH IN WHOLE GENOME ASSEMBLY OF *PENAEUS INDICUS*



Circos plot of Indian white shrimp, Penaeus indicus depicting the alignments and structural variations

Bulk of Indian shrimp production thrives on imported *Penaeus vannamei* broodstock. To reduce the dependency on exotic species, in recent years, emphasis was given to improve the domestic shrimp species, *Penaeus indicus* which has wide natural distribution along the Indian coast. In this direction, the institute has put enormous efforts to build genomic resources for *P. indicus* including the annotated assembly of complex and highly-repetitive nuclear genome. Initial efforts with short-read sequence datasets and the conventional assemblers could only produce a fragmented assembly. Successful genome assembly was achieved only after overcoming issues related to DNA quality and sequencing, and employing latest assembly tools. Long-read sequence datasets with WTDBG2 assembler could produce a quality assembly for *P. indicus* which is of 1.93 Gb length (~ 78% of genome) with N50 scaffold length of 34.4 Mb.

Considering the large genomes of >1.5 Gb length, the assembly presented for *P. indicus* is the only crustacean genome and one among the only nine invertebrate genomes sequenced so far, to meet the reference standard of 1 Mb contig N50 and 10 Mb scaffold N50 lengths. On comparison to other shrimp genomes having less contig lengths, the assembly of *P. indicus* has 346 un-gapped contigs of over 1 Mb. The assembly approach that involved generating contigs with Pacbio subreads, polishing for indels with Illumina paired-end reads and scaffolding with HiC chromatin interaction data yielded a superior contiguous assembly for *P. indicus*. The repeat elements, a prominent feature of shrimp genome, constitute about 49% of the assembled *P. indicus* genome. Interestingly, the *P. indicus* genome assembly was found to have highest (31.99 %) proportion of simple sequence repeats among sequenced animal genomes.

Combined evidence from *ab-initio* gene prediction, Illumina RNAseq data, Pacbio Iso-Sequencing data and protein sequences from related species, identified 28,720 protein-coding genes in the *P. indicus* genome. The mean exon and intron lengths were 259 bp and 2315 bp respectively. The contiguous genome assembly and the associated genomic resources would have applications in genetic improvement programs, stock management & ecology and evolutionary studies for the species.

WINTER HARVEST OF *PENAEUS VANNAMEI*: A SUCCESS STORY FROM SOUTH GUJARAT

South Gujarat, the most intensive shrimp farming region in the Gujarat state enjoys a fair winter season from November to February wherein night temperatures drop to as low as 10-12°C. Shrimp farming in Gujarat comprises of two farming seasons, 1st crop from March to June, and a 2nd crop that is practiced by few farmers from July/August to November/December. The winter season is usually a closed period for shrimp farming and ponds remain idle due to low water temperatures and the assumption of poor shrimp growth. To evaluate the feasibility of farming *P. vannamei* during winter, NGRC of ICAR-CIBA carried out a commercial farming trial at its research farm in Matwad Village, Navsari District, wherein the entire rearing period fell within the winter season in south Gujarat.

P. vannamei post larvae (PL-7) were initially stocked @1850 individuals/m^3 during the last week of October 2020 in four large hapas (5m x 5m x 1m) installed in the same earthen grow-out pond (1-acre) for one-week nursery rearing. The final stocking density was 33 individuals/m^2 and the entire rearing period fell within the winter season. The highest and lowest, and the average day and night atmospheric temperatures experienced during the culture period was 36°C and 13°C, and 30.96 ± 0.26°C and 19.62 ± 0.24°C, respectively. The mean water temperatures in the early morning (0500 to 0700 h), late afternoon (1500 to 1700 h), and night (2100 to 2300) were 21.92 ± 0.23°C, 25.37 ± 0.42°C and 23.50 ± 0.21°C, respectively. Water salinity ranged from 9 ‰ at the time of stocking to 24 ‰ at the time of harvest after 120 DOC. The shrimp were fed using ICAR-CIBA's formulated feed Vanami*Plus* four times a day and the morning feed was delayed until daybreak for water temperatures to rise. Starting from 45 DOC, the shrimp feed was supplemented using Vitamin C, and a mixture of mannan oligosaccharide, β 1-3 glucan, and β 1-6 glucan at 5g/kg feed for two feeding sessions to enhance the immunity of shrimp and increase its resistance to stressful conditions.

Shrimp attained a mean body weight of 20.88 g at the end of 120 days and resulted in total production of 2,633 kg of shrimp. The survival rate and FCR were 97 % and 1.07 respectively. The average weekly and daily growth rates were 1.2 g/week and 0.1738 g/day respectively. Interestingly, even during the peak winter from the last quarter of December to the 3rd quarter of January, the average weekly growth rate observed between 64 and 90 DOC was 2.01 g/week. The economic evaluation indicated that the trial resulted in a net return of ₹ 3.19 lakhs with a production cost of ₹ 242 and a profit margin of ₹ 122 per kg shrimp produced. As the growth rate and the total shrimp production were economically viable and profitable, shrimp farming regions that experience mild winter conditions, *i.e.*, South Gujarat and parts of West Bengal, wherein a majority of the farms traditionally remain idle can be effectively used to raise farmed shrimp in the winter season. This, in turn, increases the volume of shrimp that can be produced from a unit area contributing to increased production of shrimp in the country.

CIBA-PLANKTON^{PLUS} AND CIBA-HORTI^{PLUS}: FINDING VALUE IN FISH WASTE

ICAR-CIBA has developed a unique technology for converting fish waste into two cost-effective and eco-friendly value-added products branded as CIBA-Plankton^{Plus} and CIBA-Horti^{Plus}. The technology has been developed under the "waste to wealth" concept of Swachh Bharat initiatives of Government of India. The fish waste generated from fish markets in and around Chennai is not properly disposed of or recycled. Most fish waste are dumped in nearby seashores causing environmental pollution that affects the coastal communities. In this context, the technology developed by CIBA on transforming fish waste into value-added products plays a pivotal role in the circular economy.

CIBA has established the "Fish Waste Processing Unit" in 2019 for recycling of fish waste to value-added products in the Nambikkai Nagar, Pattinapakkam, Chennai, Tamil Nadu, and subsequently signed an MoU for transferring Plankton^{Plus} and Horti^{Plus} production technology to Nambikkai Fish Farmers Group. The fish waste processing unit can produce 4 tons of fish waste hydrolysate per month. The unit has produced 27 tonnes of Plankton^{Plus} and 1.2 tonnes Horti^{Plus} from May 2019 to April 2021 and earned a revenue of ₹ 19 lakhs. The products are purchased by the shrimp/fish farmers from the east and west coast. As of now entrepreneurs from West Bengal and Andhra Pradesh signed MoU with ICAR-CIBA for fish waste processing technology and two firms from Andhra Pradesh and Kerala have signed MoU for marketing rights of the value-added products. The Nambikkai Fish Farmers Group was also recognized as the "Best Fisheries Self Help Group 2020" by National Fisheries Development Board (NFDB), Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India.

The products showed promising performance for all the candidate species in brackishwater aquaculture and horticulture in yard experiments as well as field demonstrations. The Plankton^{Plus} is effective under a wide range of salinities from 0 to 47 ppt and enhances the abundance and diversity of phyto and zooplankton in different culture systems. It reduces the requirement of formulated feed for shrimp and fish without affecting growth and production performance. It improves the survival of shrimp and fish by 10 to 15% and enhances average body weight by 9 to 19%. The technology has the potential for doubling the farmers' income and also to improve their socio-economic status. Besides, it provides alternative livelihood to fishermen and has the potential for hygienically disposing fish waste from fish markets across the country. The by-product from fish waste hydrolysate preparation is named as Horti^{Plus} that can be used as an organic manure in horticulture. Horti^{Plus} is rich in available nitrogen and phosphorus, calcium and trace minerals. Performance of Horti^{Plus} was tested in different crops (Brinjal, Ladies finger and Spinach) and it improved vegetative and reproductive growth. The application of Horti^{Plus} also improved the soil health and the dosage required for obtaining maximum yield in horticulture crop has been standardized at 2 tonnes/ha.

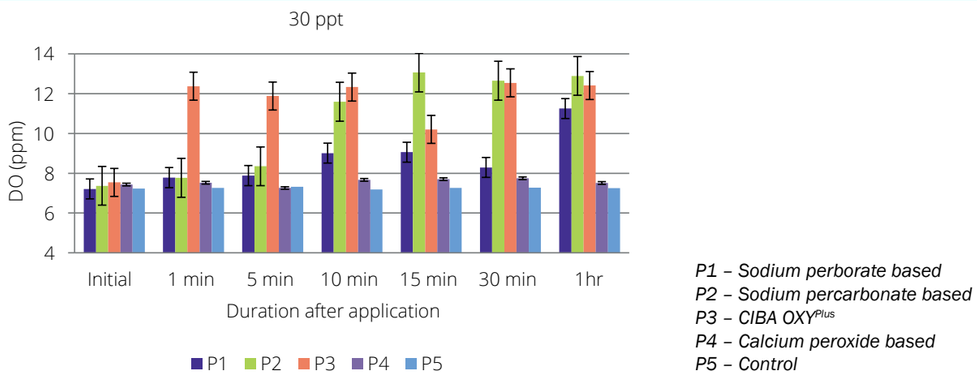
> CIBA-Plankton^{Plus}, the unique liquid product developed by ICAR-CIBA from marine fish trimmings/waste is a nutrient-rich soup with high protein (45-55%), lipid (15-20%), amino acids (Histidine, Cysteine, Lysine, and glutamic acid), essential fatty acids (EPA & DHA) and mineral contents.
>
> For the production of 40,000 kg of CIBA-Plankton^{Plus} in an year, fixed capital of ₹ 2 lakhs and working capital of ₹ 20 lakhs are required. Net profit from the production is more than 6 lakhs per year.

CIBA OXY*PLUS* FOR ENHANCING DISSOLVED OXYGEN IN AQUACULTURE PONDS

Maintaining optimum water quality is the fundamental principle for successful aquaculture. Dissolved oxygen (DO) is the most crucial parameter that affects the growth and survival of aquatic animals. DO in aquaculture ponds vary with the weather parameters and management practices. Higher stocking density with high feeding in intensive farming reduces the DO levels.

DO levels are higher during the day time reaching a peak in the afternoon and gradually start reducing following the sunset, with lowest DO levels during the early morning hours. Sudden changes in the weather parameters also result in low DO levels in shrimp and fish culture ponds. To mitigate the problem of low DO due to intensive culture practices and vagaries in weather parameters, oxygen releasing compounds could be utilised. ICAR-CIBA has developed CIBA OXY*Plus* with sodium percarbonate and perborate as active ingredients combined with activators, and stabilisers for enhanced and sustained DO release in aquaculture ponds.

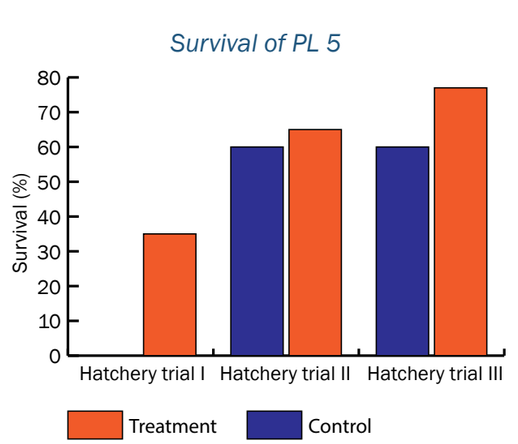
CIBA OXY*Plus* was proven to be effective in enhancing DO in comparison to the commercially available products. It raised DO to 12 ppm within 1 minute of application and sustained the DO level over 10 ppm for one hour in a shrimp culture pond with a salinity of 30 ppt. The dosage for CIBA OXY*Plus* is 1 kg per acre when the DO level is less than 5 ppm and 2.5 kg per acre under a lower DO level of less than 3 ppm.

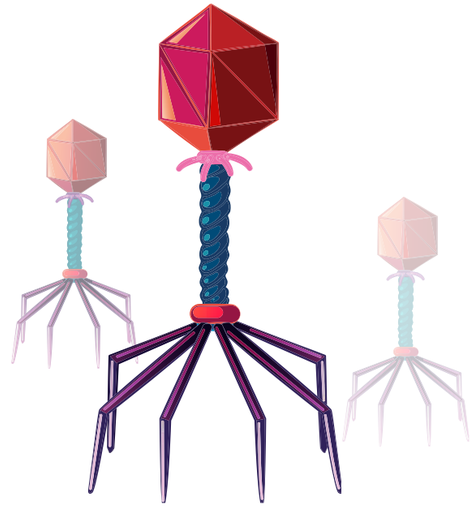


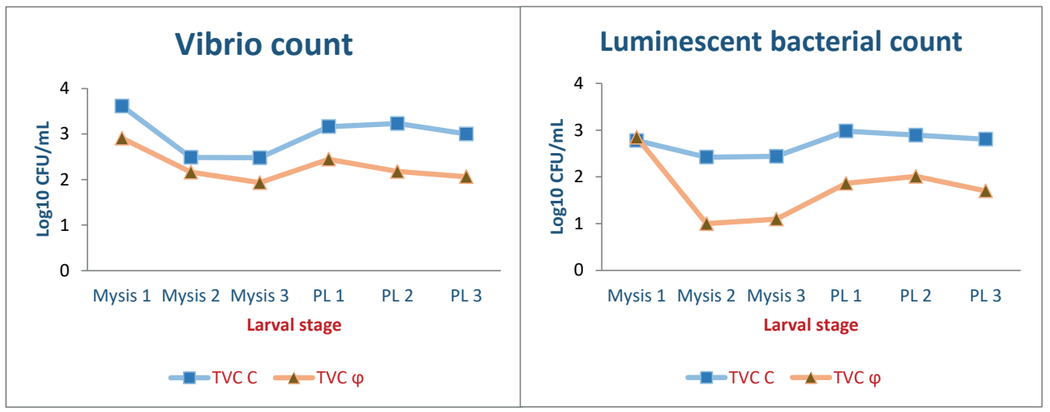
P1 – Sodium perborate based
P2 – Sodium percarbonate based
*P3 – CIBA OXY*Plus*
P4 – Calcium peroxide based
P5 – Control

PHAGE THERAPY FOR THE CONTROL OF LUMINESCENT VIBRIOSIS IN SHRIMP HATCHERIES

Phage therapy has emerged as an environment-friendly, safe alternative to antibiotics for controlling bacterial diseases. Bacteriophages also called 'phages', are viruses that infect and kill bacteria. Taking the advantage of natural killing behaviour of bacteriophages, ICAR-CIBA developed phage therapy for controlling vibriosis in shrimp hatcheries which can cause up to 100% mortality during mysis and early-postlarval stages. The efficacy of the phage therapy was confirmed by screening more than 100 bacteriophages against more than 100 luminescent bacterial isolates collected over two decades. Mass production, purification, and storage methods of phages were standardised during the technology development and filed for a patent in 2018. A cocktail of four phages with a broad spectrum of host specificity and complementary lytic behaviour were formulated into a consortium named 'Lumi*Phage*'. The efficacy of the phage consortium was confirmed by a series of field trials in commercial shrimp hatcheries and found to kill a wide range of luminescent bacteria such as *Vibrio campbelii* and *V. harveyi.* After a series of commercial trials, the phage technology was commercialised for mass production and distribution to M/s. Salem Microbes Private Limited, Salem, Tamil Nadu. The technology is expected to reduce the incidences of larval diseases in shrimp hatcheries and will pave the way for antibiotic-free larval rearing systems in aquaculture.







TVC C= Total Vibrio Count (Control); TVC φ= Total Vibrio Count (Phage)

STREAKED SPINEFOOT

(*SIGANUS JAVUS*)

The family "Siganidae" is distinguished by the laterally compressed body and small terminal mouth with a single row of compressed, incisiform teeth in both jaws. Pelvic fins, each with two strong spines and three soft rays between them, a character unique to this family. The species possess a single dorsal fin with 13 strong spines and 10 soft rays and the anal fin comprises of 7 strong spines and 9 soft rays. The scales are cycloid.

The streaked spinefoot (*Siganus javus*) is a commercially important species of rabbitfish. Like all rabbitfishes, it has venomous spines on the dorsal, anal, and pelvic fins. It is a herbivore, mainly feeding on algae in shallow, coastal waters, brackish water lagoons, and rocky or coral reefs (depth of 2-20 m). It is distributed throughout the Indo-Pacific region, in groups usually consisting of 10 members. It has an adult size ranging between 25 and 55 cm.

Because of their fast growth rates, herbivorous feeding behaviour, and economic value, streaked spinefoot is considered an important food fish. Additionally, due to its attractive color, adaptability to aquaria and easy acceptance of formulated feed, streaked spinefoots are also marketed as brackishwater ornamental fish. ICAR-CIBA has initiated the breeding of *S. javus* and 2 batches of 250 sub-adults are maintained on formulated feed to develop the broodstock.

KINGDOM	:	**Animalia**
PHYLUM	:	**Chordata**
CLASS	:	**Actinopterygii**
ORDER	:	**Perciformes**
FAMILY	:	**Siganidae**
GENUS	:	***Siganus***
SPECIES	:	***Siganus javus***

Shri. Giriraj Singh, Hon'ble Union Minister, Ministry of Fisheries, Animal Husbandry & Dairying, Govt. of India, visited Muttukadu Experimental Station of ICAR-CIBA

Shri. Giriraj Singh, Hon'ble Union Minister of Fisheries, Animal Husbandry & Dairying (MOFAHD), Govt. of India visited the shrimp and finfish hatchery complex located at MES of CIBA on 21st January 2021 and had discussions with scientists on the new developments in R&D at the institute. The minister showed special interest in the breeding and farming of Indian white shrimp (*Penaeus indicus*) initiated by CIBA and emphasized to initiate a jump start programme on the hatchery production and farming of *P. indicus*, for the benefit of Indian shrimp farmers. He also appreciated the initiatives by CIBA in the development of indigenous hatchery technologies for brackishwater finfish, and handed-over the seabass seed produced by CIBA to the farmers and complimented CIBA's effort in working in tandem with the sectoral requirements. Subsequently during the interaction meeting led by the Hon'ble Union Minister, Rajeev Ranjan, IAS, Union Fisheries Secretary, Dr. K. Gopal, Principal Secretary, Fisheries, Govt. of Tamil Nadu, Dr. J. Balaji, IAS, Joint Secretary, MOFAHD, Dr. V. Kripa, Member-Secretary, Coastal Aquaculture Authority, Govt. of India, scientists, farmers and development department officials participated. Dr. K.K. Vijayan, Director, CIBA highlighted the recent R&D accomplishments, recognitions received by the institute and CIBA adopted/mentored farmers/entrepreneurs. He flagged the importance of promoting Indian white shrimp (*Penaeus indicus*) species for farming in India to compliment the exotic vannamei and elaborated CIBA's R&D initiatives on the species and a road map for developing a selective breeding programme on a consortium mode. During the occasion, the minister released the import substitute for shrimp larval feed using 'Black Soldier Fly meal' developed by CIBA, partnering with a 'Soldier Fly Startup'. Later the Minister honoured the CIBA's clientele M/s. Nambikkai Fish Farmers Group, Tamil Nadu and M/s. Sai Aqua Feeds, Andhra Pradesh, who were awarded by National Fisheries Development Board (NFDB), with the "*Best Fisheries Self Help Group-2020*" and "*Best Fisheries Enterprise Award-2020*" for their successful ventures on 'fish waste-to-wealth' and 'feed processing technology' of ICAR-CIBA respectively.

TECHNOLOGY TRANSFERS, PRODUCT RELEASES AND KNOWLEDGE PARTNERSHIPS

ICAR-CIBA's new start-up initiative for the production of 'Black Soldier Fly meal' as an effective and sustainable replacement for fish meal

ICAR-CIBA joined hands with a team of young entrepreneurs led by Mr. C. Bhanu Prashanth by signing a MoU on 20th January, 2021 to explore the possibilities of using black soldier fly meal (BSF meal) as a sustainable ingredient in aqua feed. Finding nutritionally appropriate and sustainable alternatives to fishmeal and fish oil for high-quality protein is an applied research area in aqua feed industry. Recently, insects have received significant attention as a new ingredient for aqua feed as they deliver several advantages like low environmental impact, ability to grow on waste and by-products with better feed conversion efficiency, and a lower risk of transmitting zoonotic infections. In the present start-up, the remarkable nutrient-recycling capacity of the black soldier fly would be used to convert organic waste into high-quality protein within a short period of time. In metro cities like Chennai, massive volume of organic waste is generated every day, that is expensive to dispose and leads to harmful methane emissions. The start-up initiative, plans to collect kitchen waste rich in nutrients from multi-storied residential apartments, and subject them to biological processing by BSF *Hermetia illucens*, yielding a high-quality protein and lipid-rich meal, whereas the residual matter rich in inorganic nutrients can be used as an organic fertilizer for agriculture. According to Dr. K.K. Vijayan, Director, CIBA, this effort will undoubtedly provide a cost-effective alternative to fish meal, contributing to the sustainability and competitiveness of the aqua feed sector. This is clearly a waste to wealth strategy and a circular economy concept, where waste forms the new starting material for other industrial processes.

ICAR-CIBA partners with farmer-entrepreneur for establishing a multispecies integrated feed mill to facilitate diversification of brackishwater aquaculture in Andhra Pradesh

Technology support for diversification of brackishwater aquaculture by having species choices of different feeding habits and farming

requirements to utilize the diverse resources sustainably is one of the mandates of ICAR-CIBA. In any aquafarming, success depends on quality seed and feed, which in turn determine the economic returns and profitability. CIBA has successfully contributed to the critical nodes of this farming value chain of candidate shellfish and finfish with seed, feed, health care and region-specific farming technologies. In this setting, CIBA formed a strategic alliance with an enterprising brackishwater farmer, Mr. Mandava Venkata Naveen from Nagayalanka region of Andhra Pradesh, for an integrated feed mill to produce indigenous formulated growout feeds for candidate brackishwater fish species by signing a MoU on 17th Feb, 2021. CIBA has developed cost-effective and quality 'desi feeds' using indigenous feed ingredients for all the candidate species farmed in brackishwater. The integrated feed mill envisages to produce species-specific formulations with the technical collaboration of CIBA, for their own use and subsequent sales to nearby farmers. During the event, Dr. K.K. Vijayan, Director, ICAR-CIBA, impressed upon the quality of the feed *vis-a-vis* the cost of production and emphasized that, this integrated feed mill initiative is the first of its kind in this region and would be a boon for aqua farmers in the future.

ICAR-CIBA partners with 'Wellgrow Feeds' under the start-up initiative for establishing a small scale integrated feed mill at Kannur, Kerala

Diversification of brackishwater aquaculture is gaining considerable momentum in India and is very evident in state of Kerala, owing to its diverse resource base. Different species of finfish are farmed in brackishwater regions of Kerala. However, the major bottleneck for the large-scale propagation of brackishwater aquaculture in the state is the availability of cost effective and quality feeds. Formulated feeds used in the states are totally sourced from the East coast. In this context, ICAR-CIBA has decided to partner with Wellgrow Feeds', Kannur, Kerala by signing a MoU on 24th March, 2021 to establish an integrated feed mill to produce indigenous formulated, functional and grow-out feeds for brackishwater aquaculture development in the west coast. During the event, Dr. K.K. Vijayan, Director, CIBA, articulated that quality feed should give optimum productivity along with cost effectiveness and CIBA feeds are capable of delivering both the requirements. Further, he emphasized that, this integrated feed mill initiative is the first of its kind in west coast and would be a boon for aqua farmers in the region. Mr. Augusthy Varghese, who represented the Wellgrow feeds, opined that there is a considerable demand for quality feed in the West coast and this initiative will help the small and medium farmers.

Dr. J.K. Jena, Deputy Director General (Fisheries) released ICAR-CIBA products CIBA-Nodavac-R and CIBA OXY*Plus*

ICAR-CIBA, Chennai has developed an indigenous vaccine against viral nervous necrosis (VNN) that affects several fish species and a dissolved oxygen (DO) enhancing product for aquaculture ponds. Dr. J.K. Jena, Deputy Director General (Fisheries), ICAR released the recombinant VNN vaccine, CIBA-Nodavac-R and CIBA OXY*Plus*, a mixture of sodium perborate and sodium percarbonate salts along with stabilisers in the presence of Dr. S.K. Chaudhari, Deputy Director General (NRM), ICAR and Dr. V.K. Singh, Director, ICAR-CRIDA in a virtual event held on 27th April, 2021. Dr. Jena congratulated CIBA team for developing the vaccine and DO enhancer.

Dr. K.K. Vijayan, Director, ICAR-CIBA, explained the importance of vaccine in controlling the disease and mentioned that, this is the first vaccine to be released for aquaculture in India and will help to prevent VNN in fish hatcheries and grow-out farms. Dr. M. Makesh, Principal investigator, Consortium research platform on vaccines and diagnostics mentioned that, the vaccine developed under the project can be used in all the species susceptible to VNN such as seabass, milkfish, grey mullet, Mangrove red snapper *etc.*

Concerning CIBA OXY*Plus*, Dr. K.K. Vijayan elucidated that to mitigate the problem of low DO due to intensive practices and vagaries in weather parameters, this product could be utilised. Dr. M. Muralidhar, Principal Investigator of "National Initiatives on Climate Resilient Agriculture (NICRA), mentioned that, this product was developed under this project by Dr. P. Kumararaja, Senior Scientist and team.

MoU signing for CIBA Plankton*Plus* technology transfer

Dr. K.K. Vijayan, Director, CIBA, signed a Memorandum of Understanding (MoU) with M/s. T.K. Enterprise, Kakdwip, West Bengal for technology transfer of CIBA-Plankton*Plus* developed by ICAR-CIBA at Kakdwip Research Centre of CIBA on 3rd April 2021. He highlighted the importance of this technology by converting the fish trimmings/waste to value-added products, on a 'waste to wealth' platform. He articulated that the CIBA Plankton*Plus* is capable of enhancing aquaculture production in various salinity regimes. He complimented M/s. T.K. Enterprise for recognizing the potential of CIBA in R&D backstopping for brackishwater aquaculture and coming forward to sign the MoU. He also stressed the requirement of continued research in refining and fine-tuning the products from fish waste.

ICAR-CIBA launched the online version of Aquastat

ICAR-CIBA developed and launched an online version of brackishwater aquaculture database (online Aquastat) by collecting and collating major data components on various aspects of brackishwater aquaculture *viz.*, Global and Indian scenario of brackishwater aquaculture, production and trade statistics etc. Dr. K.K. Vijayan, Director, ICAR-CIBA inaugurated online Aquastat in ICAR-CIBA website during the occasion of 38th Institute Research Council (IRC) meeting on 27th April, 2021. During the inauguration he pointed out that, this database will serve as one destination data point for all sectors of brackishwater aquaculture in the country. The data will be updated on yearly basis with a hard copy version, and every six months in online version. Aquastat database can be accessed at www.ciba.res.in/aquastat link in which Aquastat data for world, India and its states are included with suitable search options. It is useful to the planners, policy makers, researchers, state department officials, students, academicians, research scholars and other stakeholders in aquaculture as ready reference.

ICAR-CIBA (2015-2021): GLIMPSES OF MAJOR ACHIEVEMENTS

ICAR-CIBA with a vision of environmentally sustainable, economically viable and socially acceptable brackishwater aquaculture, involved in research and development related to the production of quality finfish and shellfish seeds, genetic improvement, cost-effective feeds, environment monitoring, farm and hatchery management, disease diagnosis, disease monitoring and social research etc.

As the brackishwater aquaculture sector has come through decades of several ups and downs, technology backstopping through R&D from the research institutions such as CIBA, promotion and policy support from the central and state govt and other promotional agencies are the key in the sustainable growth of the sector. CIBA has always been at the forefront in developing new technologies and supporting the sector, and making timely contributions in policy making with technical inputs and data support, playing the role of an R&D partner effectively.

In this direction, CIBA has made commendable progress in the thematic areas of brackishwater farming like diversification of species and farming system; cost effective and indigenous formulated feed development; disease diagnostics and health management; genetics, genomics and stock improvement; social engineering and technological support for policy making of the govt and government agencies.

DIVERSIFICATION OF SPECIES

Breeding and seed production of mangrove snapper (*Lutjanus argentimaculatus*), another potential candidate to Indian brackishwater farming basket:

In July 2020, a breakthrough was achieved in breeding mangrove red snapper at the fish hatchery, MES, ICAR-CIBA, Chennai, for the first time in this country, and this May 2021, the first batch of hatchery bred redsnapper seeds were distributed to the prospective brackishwater farmers of southern states. Red snapper is a high-value food fish with a premium price in the market that attains table size within a short period of 5-6 months; the adoption of technology by the private players will open up a new avenue in the brackishwater farming sector.

Breeding of grey mullet (*Mugil cephalus*) in captivity:

CIBA has successfully bred the grey mullet (*Mugil cephalus*; Thirutha, Madavai), a high-valued commercial brackishwater fish, for the first time in the country, in line with Government of India's push on increasing fish production under the blue revolution mission. This has remained elusive for more than three decades. In the CIBA's mission on species diversification and enriching the species basket, this omnivorous species with high market demand provides a great opportunity to the farmers, due to its faster growth and omnivorous feeding habits and acceptance of formulated feeds.

Brackishwater ornamental fish portfolio:

For the first time in India, a bunch of five species of finfishes (silver moony, spotted scat, orange chromide, green chromide and canara pearlspot) was identified as potential brackishwater ornamental fishes and technologies were developed for breeding in captivity, nursery rearing, indigenous functional feeds, and protocols for managing their display in aquariums.


Spotted scat

Production of hilsa fingerlings in captivity through dry stripping of hilsa broodstocks, larval rearing, seed production and farming in brackishwater ponds:

To promote sustainable farming and improvement of natural stock of hilsa in the Bengal and Sundarban deltaic region, CIBA developed seed production technology using dry stripping of wild caught male and female fishes, and larval rearing in captivity. Nursery reared juveniles were farmed in ponds using hilsa specific formulated feeds developed by CIBA. This would lead to the production of farm reared hilsa, and their availability in the market.

Captive breeding of *Mystus gulio*: Yet another brackishwater fish for region specific markets:

Kakdwip Research Centre of CIBA has developed a comprehensive technology comprising of captive breeding, larval rearing and grow-out culture of this catfish locally known as Nuna Tengra in Bengal region. Mystus catfish has ready demand in Bengal, with a price tag of ₹ 400-500/kg. This breeding technology has been taken up by the Andhra Pradesh Government to set up a hatchery in the state, to facilitate the farming.

Indigenous technology for milkfish breeding, nursery rearing and grow-out:

Milkfish is a fast-growing brackishwater food fish ideal for farming with low input costs, due to its herbivorous feeding habit. Lack of fish seed and want of hatchery seed production technology has been the bottleneck. For the first time in this country, induced breeding of milkfish was achieved in June 2015, a milestone in the history of Indian aquaculture development. The hatchery technology has been transferred to private entrepreneur, and the first milkfish hatchery will be set up in the state of West Bengal.

DIVERSIFICATION OF FARMING SYSTEM

Modular hatchery technology for pearlspot fish, *Etroplus* spp.:

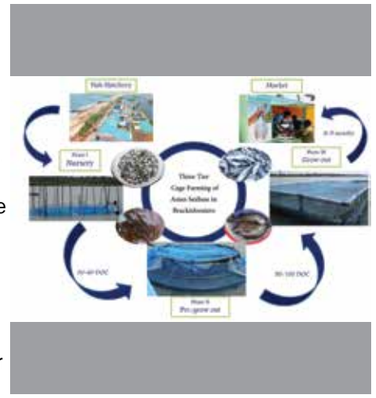
Pearlspot is a native fish of India. Being an omnivorous feeder, the fish can be raised with a low input cost. Its complex parental care and low fecundity were challenging in seed production and farming. CIBA developed a simple modular hatchery and technology for the pairwise breeding and larval rearing in a homestead system. The technology can be easily adapted by SHGs and small families without much investment cost and is ideally suited for small states like Kerala to increase seed production and farming of the species.

Biofloc based aquaculture and floc consortium " CIBAFLOC":

Biofloc technology is considered as a GREEN TECHNOLOGY for sustainable seafood production. CIBA optimized the biofloc technology for farming of shrimp. In biofloc technology, microbial biomass serves as a natural *in situ* feed for the farmed species and improves nutrient recovery and production economics. Further, a microbial consortium was developed which facilitates *in situ* bioremediation, cleaning the nitrogenous wastes in the rearing water and get converted into nutrient-rich microbial biomass.

Seabass farming in customized open water cages adopting a three-tier model - a most efficient option for doubling the farmer's income:

CIBA successfully demonstrated cage farming of Asian seabass using a three tier model in both the east and west coasts of India along with state departments and Mangrove Foundation respectively. In grow-out farming, juveniles were grown to a marketable size of 0.9–1.25 kg in 6 months with FCR of 1.85:1 (1.85 kg feed to produce 1 kg fish). In both the places the production cost was worked out to be ₹ 190-220 per kg of fish, and sale price at the farm gate was around ₹ 380–450 per kg with a Benefit: Cost ratio of 2. Two cycles of production can be taken in a year, with proper planning and execution. This farming model can be promoted as a value chain, with a concept of 'hatchery to plate', a highly profitable brackishwater cage farming model.



Nationwide farming demonstration of Indian white shrimp as a supplementary species to exotic Pacific white shrimp:

Multi-locations culture demonstrations of Indian white shrimp (*Penaeus indicus*) were carried out in all the coastal states. The production performance of *P. indicus* in terms of growth, productivity and disease occurrence were scientifically analyzed, comparing the results from all the on-farm trials. In all the demonstration trials, the WSSV free post larvae produced by the supervision of CIBA were used. Average production of 2–6.5 mt/ha at a stocking density of 35 PL/m^2 were obtained. The shrimps were fed with CIBA formulated Indicus^{Plus} feed.

Technology for crab farming in 'Three-tier or zero stocking' model:

Mud crab (*Scylla* sp.) is a high-value seafood most suitable for low intensive brackishwater farming. But its long rearing period (10-12 months; 1 g to above 500 g), poor survival, and associated production loss is always discouraging for the farmers. To avoid this, a three tier modular farming system or zero stocking model was developed by ICAR-CIBA. Here, rearing of crablet (button crab), from 1 g to 700 g harvestable size is done in 3 phases, of 3 months each, so that the farmer can get their cost at the end of 3 months, and pass on the crab to the next farmer.

COST EFFECTIVE INDIGENOUS FEED DEVELOPMENT

Indigenous functional aquarium feed "Kalorfish^{Plus}":

Considering the potential of the ornamental fish industry and the dominance of Indian aquarium trade by imported feeds, CIBA developed indigenous aquarium feed with optimum nutrients and functional properties, with a focus on colour and health. The feed is branded as "Kalorfish^{Plus}", which was commercialised, and has been made available to the ornamental fish hobbyists.

Indigenous cost-effective vannamei shrimp feed: Vanami^{Plus}:

Indian shrimp feed market in the year 2019, was about a million tonnes worth ₹ 7000 to 8000 crores. Increasing shrimp feed prices and escalating cost of production is a major challenge facing Indian shrimp farming, affecting profitability of the farming operations. ICAR-CIBA took strategic effort and developed a cost-effective 'Desi feed,' Vanami^{Plus}, by identifying the untapped indigenous feed resources. Vanami^{Plus} has sub-series of feeds for different shrimp life stages such as a larvae, nursery, grow-out and finisher feeds. The feed available in the market through commercialization, showed wide acceptability among farmers, which helped to reduce the cost of production, and increased profits for farmers.

One of the MSME from Andhra Pradesh, who adopted the CIBA technology for Vanami^{Plus}, received national award in 2020, from NFDB, Ministry of Agriculture and Farmers Welfare, Govt. of India.

Seebass^{Plus} – a cost effective indigenous feed for farming of Asian seabass:

Scientifically formulated balanced feed for seabass, *Lates calcarifer* and its different life stages *viz.,* larvae, juveniles and adults were developed by ICAR-CIBA. The feeds were formulated to utilize locally available sustainable ingredients for cost effectiveness without compromising the attractability, palatability and growth performance. The feed is enriched with EPA, DHA and immune boosters for disease resistance and final product quality. When tested widely in cage farming of seabass, the feed resulted in performance with imported brands, with a cost advantage of ₹ 10-20/kg, that translates as an increased profit for the farmers.

EtroBrood^{Plus} - An indigenous broodstock feed for parental nutrition:

Pearlspot is a potential candidate for brackishwater farming. Farmers produce pearlspot seeds in large ponds in a traditional manner by feeding the adults with commercial carp feeds and farm made feeds, which is uneconomical. CIBA developed a broodstock diet (EtroBrood^{Plus}) to provide specific nutrients vital for maturation and spawning, and demonstrated for the first time that pearlspot can be made to spawn more than 4 times/year (average) in 1000 L tanks with an average fry yield >2200/spawning.

DISEASE DIAGNOSTICS AND AQUATIC HEALTH MANAGEMENT

RT-PCR based diagnostic kits for EHP in shrimp:

Dignostic kits based on Real time Quantitative PCR and nested PCR were developed for the diagnosis of EHP. *Enterocytozoon hepatopenaei* (EHP) causes hepatopancreatic microsporidiosis in farmed shrimp and has been a growing concern world over, including in India. The disease is often associated with severe growth retardation and/or white faeces syndromes in farmed shrimp. An indigenous cost-effective, user friendly diagnostic kit for detection of EHP by nested PCR was developed based on the sequence of 18s small subunit rRNA (SSU rRNA) gene of the EHP isolates in India.

Improved WSSV – RT- PCR diagnostic kit:

A simple, sensitive, cost effective and user-friendly improved WSSV - PCR diagnostic kit has been developed based on TATA-box binding protein gene of WSSV. Decapod β-actin gene has been incorporated as an internal control to eliminate false negative reactions. This assay is designed for the specific and sensitive detection of WSSV and is 10 to 50 times more sensitive than other nested PCR assays. The assay kit contains all the required materials and reagents for DNA isolation and PCR and presented in such a way that handling is limited to the minimum. The kit was commercialised to a start-up company 'Aura Biotechnologies Limited', in May 2017.

CIBAMOX – a microbial product to reduce ammonia and nitrite problems:

CIBAMOX is a water probiotic containing an innovative combination of autotrophic ammonia oxidizing, nitrite-oxidizing and denitrifying bacterial consortia from coastal environments, selected for their fast growth and high yield and enhanced detoxification efficiency under standard conditions developed for mitigation of nitrogenous wastes in aquaculture ponds. Product is commercialised and widely used by the farmers.

CIBA-PARACIDE for treatment of parasitic infestations in food and ornamental fishes:

Parasitic infestations are a challenging issue in achieving optimal production in both food and ornamental fish farming. CIBA has developed an anti-parasitic formulation, CIBA-PARACIDE, for oral application. 'CIBA-PARACIDE' is effective in the treatment of *Argulus* spp., *Caligus* spp., *Lernanthropsis* spp., *Lernaea* spp. in Asian seabass, pearlspot, grey mullet, rohu, catla, gold fish and koi carp. The product is under commercialization.

CIBA-LUMI^{PHAGE}, a novel therapeutics for bacterial diseases in shrimp larvae:

The novel "phage prophylaxis and therapy" has been developed by CIBA using bacteriophages for the biocontrol of bacterial diseases, particularly vibriosis, especially in shrimp hatcheries. The novelty of the phage technology of CIBA, is the use of 'cocktail of phages' that can neutralise a wide range of pathogenic bacteria in the hatchery settings, thus helping prevention and control of bacterial diseases, replacing the use of antibiotics. The technology has been commercialized through an MoU with M/s. Salem Microbes Private Limited, Salem, Tamil Nadu in September 2020 for the production and marketing of a bacteriophage based product.

Water Quality Kits:

Optimum water quality is critical in the success of aquaculture, and every species has its unique water quality requirements for the maximum performance. Water quality parameters can deteriorate overnight; therefore, it needs regular onsite monitoring. ICAR-CIBA has developed cost-effective kits for the field level estimation of critical water parameters, and has been commercialised.

GENETICS, GENOMICS AND STOCK IMPROVEMENT

Whole-genome assembly of Indian white shrimp, *Penaeus indicus*:

After the nationwide farming demonstration of Indian white shrimp *P. indicus* as a complimentary native species to vannamei, the species has been identified as the candidate species for the stock improvement, through selective breeding. In this backdrop, the whole genome with a length of 1.93 GB, has been completed, with bioinformatic analyses.

This genome sequence is found to be the best among the crustaceans, including the recently published *Penaeus vannamei* genome. This would contribute significantly towards our effort in the flagship program on stock improvement and domestication of Indian white shrimp.

Whole genome sequencing of WSSV:

For the first time the whole genome sequencing of an Indian isolate of shrimp white spot syndrome virus was done. Whole genome sequencing of several bacterial pathogens was completed.

Whole genome sequence of *Vibrio parahaemolyticus* VP14 strain:

Vibrio parahaemolyticus is a widespread pathogen in shrimp aquaculture. Genome sequences of bacterial strain VP14 of *Vibrio parahaemolyticus* submitted to NCBI.

The genome contained 5326 genes that include 4972 coding sequences, 10 5S rRNA, 15 16S rRNA, 12 23S rRNA, 161 tRNA, 4 ncRNA and 152 pseudogenes.

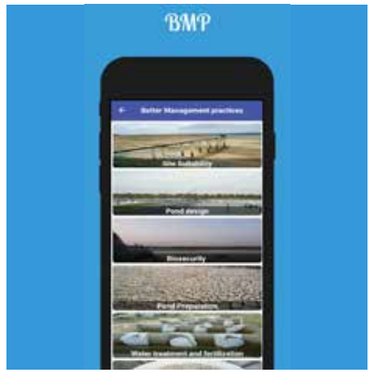
SOCIETAL DEVELOPMENT AND SOCIAL SCIENCE TOOLS

Value added products from fish waste, "a waste to wealth" initiative:

The average fish processing trimmings represent 25-50% the total fish production and these go as wastes and create a lot of sanitary burden in the environment, especially in the cities and residential places. CIBA has devolved a unique technology in which fish waste has been converted to two value-added, cost-effective, indigenous, eco-friendly quality products branded as ICAR-CIBA-Plankton^{Plus} and ICAR-CIBA-Horti^{Plus} (Patent application Number 201941009741 dated March 13, 2019). The products are developed under the concept "waste to wealth" in Swachh Bharat initiatives of Govt. of India. The start-up entrepreneur, Nambikkai SHG, who took this technology has been marketing the product across India, and they received national award for "Best Fisheries Self Help Group" by NFDB, Govt. of India.

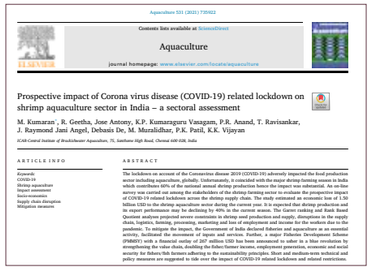
CIBA Shrimp mobile application:

CIBA has launched a mobile application-CIBA Shrimpapp-to establish a linkage with farmers and extension workers for the dissemination of the technology information and understand the field requirements. The user can download the app for free and it can work in off-line. The application contains eight modules *viz.,* better management practices (BMP), estimation of biomass and inputs, on-farm disease diagnosis, on-farm risk assessment, update and advisories, Govt. regulations, frequently asked questions (FAQs) and post a query to the scientist.



Impact of COVID-19 pandemic in the Indian shrimp sector:

The study was conducted using the CIBA ShrimpApp and other virtual tools among the farmers and stakeholders, indicated that farmed shrimp production might decline by 30-40% during the first six months of the lockdown in 2020. The annual shrimp export performance may drop by around 30%. The study also revealed that, during the pandemic, when most of the production sector was drastically impacted by the lockdown, the aquaculture industry demonstrated a fast revival as the government exempted the aquaculture operations from lockdown restrictions.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Prospective impact of Corona virus disease (COVID-19) related lockdown on shrimp aquaculture sector in India – a sectoral assessment

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ABSTRACT

The lockdown on account of the Coronavirus disease 2019 (COVID-19) adversely impacted the food production sector including aquaculture, globally. Unfortunately, it coincided with the major shrimp farming season in India which contributes 60% of the national annual shrimp production hence the impact was substantial. An on-line survey was carried out among the stakeholders of the shrimp farming sector to evaluate the prospective impact of COVID-19 related lockdown across the shrimp supply chain. The study estimated an economic loss of 1.30 billion USD in the shrimp aquaculture production sector in India and the export value of shrimp products and its export performance may be declining by 40% in the current season. The Garrett ranking and Rank Based Quotient analyses projected severe constraints in shrimp seed production and supply, disruptions in the supply chain, logistics, farming, processing, marketing and loss of employment and income for the workers due to the pandemic. To mitigate the impact, the Government of India declared fisheries and aquaculture as an essential activity, facilitated the movement of inputs and services. Further, a major Fisheries Development Scheme (PMMSY) with a financial outlay of 267 million USD has been announced to usher in a blue revolution by enhancing fish production to 22 million tonnes by 2024-25 through sustainable development of fisheries and aquaculture ensuring the fishers/fish farmers adhering to the sustainability principles. Short and medium-term technical and policy measures are suggested to tide over the impact of COVID-19 related lockdown and related restrictions.

Aquastat - Brackishwater aquaculture statistics:

Aquastat India is the comprehensive database of the world and Indian brackishwater aquaculture compared to the other aquaculture sectors, with data on resources, production and trade statistics from 1991 to date. This compendium has been brought out with information in brief about the various technical aspects of brackishwater aquaculture. Aquastat is designed as a digital database, with an yearly update that can be accessed through CIBA web portal.

NEW CENTRES

ICAR-CIBA research centre in Gujarat (CIBA-NGRC):

CIBA has added one new centre at Navasari-Gujarat, the Navsarai Research centre of CIBA (NGRC) at the Navsari Agricultural University Campus and a brackishwater farm, to cater the brackishwater aquaculture developmental needs of North west coast of India, especially the state of Gujarat, Maharashtra and Goa.

Kovalam experimental Station in Tamil Nadu (CIBA-KES):

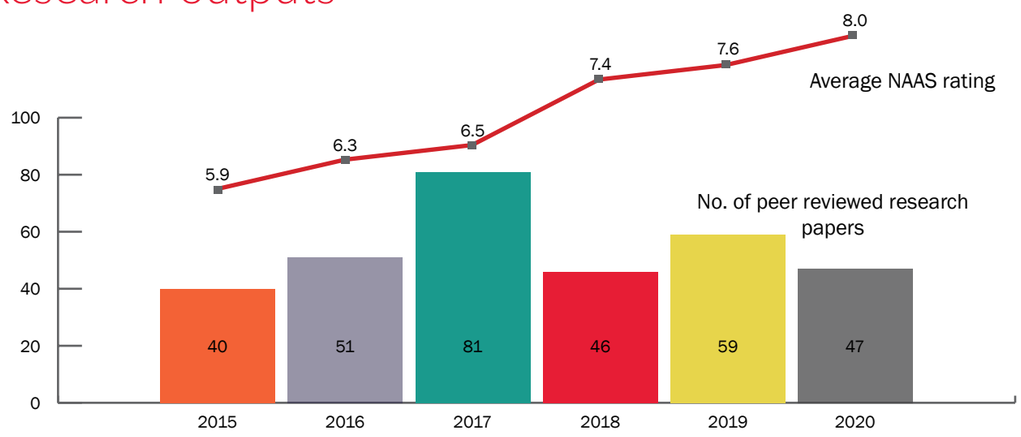
CIBA has acquired 64.55 acres of brackishwater land at Kelambakkam from the Salt board, Ministry of Commerce and Industry, Government of India, with a vision to establishing a center of excellence in brackishwater aquaculture, under CIBA, which can also serve SAARC region. This is now being developed as Kovalam Experimental Station and has been successfully inaugurated on 22nd May 2021. This land has the access to estuarine/coastal/oceanic waters which is ideally suitable for the development of diversified farming systems, brood & nursery banks and fisheries based livelihood systems.

ICAR-CIBA Head Quarters

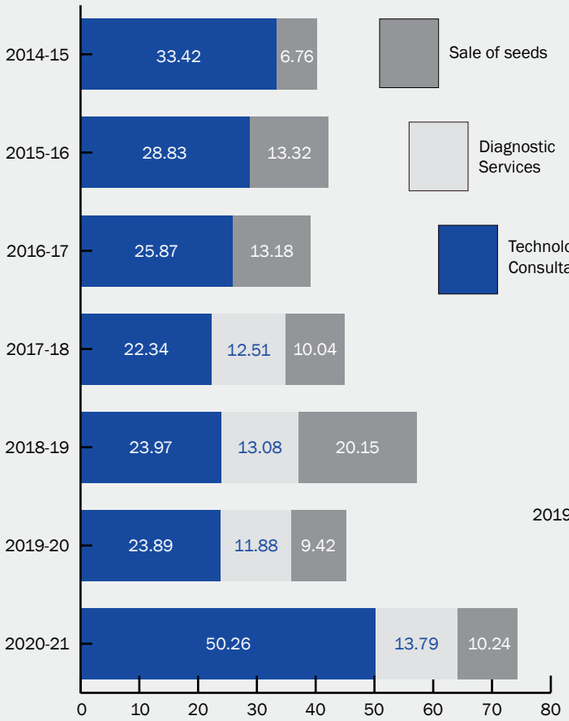
CAPTURE THE HEADLINES

ICAR-CIBA

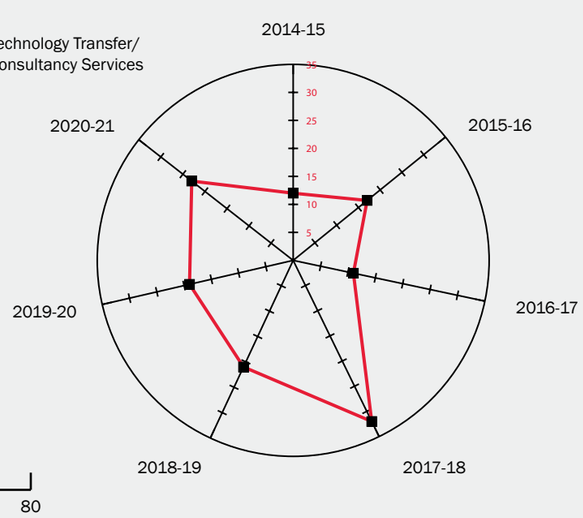
Research outputs



Revenue generated (lakhs)



MoUs signed



Intellectual property rights

ICAR-CIBA and its research centres celebrated the 72nd Republic Day of the country

ICAR-CIBA, Chennai celebrated the 72nd Republic Day by unfurling the National Flag and organized sports events for the staff and family members. At CIBA headquarters, Chennai Dr. K.K. Vijayan, Director, unfurled the tricolor national flag and greeted all the scientists and staff. On his republic day address, he highlighted the significant achievements of CIBA in science and infrastructure development in the recent past and urged the CIBA team to carry forward the programmes in the days to come. He emphasized to keep the mandate of the institute in the forward position and contributes to the brackishwater farming sector through technological backstopping. He also asked the gathering to take the brand “CIBA” to greater heights in R&D. The republic day was celebrated at regional centers: Kakdwip Research Centre of CIBA, Kakdwip, West Bengal; Navsari Gujarat Research Centre of CIBA (NGRC), Navsari, Gujarat and Muttukadu Experimental Station (MES), Muttukadu, Tamil Nadu.

ICAR-CIBA announced the indigenous hatchery technology for grey mullet, which can drive the blue revolution initiatives by Govt. of India

In a significant breakthrough, ICAR-CIBA has successfully bred the grey mullet, a high-valued commercial brackishwater fish, for the first time in the country for increasing fish production under the blue revolution mission. The success of this long-waited breeding technology was officially announced on 28th January 2021 by CIBA during a stakeholder meet organized at Muttukadu Experimental Station, Chennai in the presence of Dr. Joykrushna Jena, Deputy Director General (Fisheries) of Indian Council of Agricultural Research (ICAR), New Delhi, Dr. M. Vijayakumaran, former Principal Scientist of CMFRI & RAC member of CIBA, Dr. K.K. Vijayan, Director, CIBA, Mr. Ramachandra Raju and Mr. S. Sathish Kumar, IMC members of CIBA and Mrs. Oliver Rachael, Deputy Director, Department of Fisheries, Tamil Nadu.

As a part of this event, the first batch of hatchery produced grey mullet seeds, and Cephalus*Plus* brood stock and nursery feed was distributed to enterprising farmers from Andhra Pradesh, Tamil Nadu and Kerala. The seeds will be raised in their respective farms and developed into F1 broodstock, which would be again brought back to CIBA hatchery for further breeding and seed production. Dr. Jena presided over the function virtually and congratulated the team CIBA on this milestone. He complimented CIBA's recent efforts towards diversification through species such as Asian seabass, milkfish, and grey mullet, which is a commendable effort towards sustainable development of the dynamic brackishwater aquaculture sector. Dr. K.K. Vijayan, Director, ICAR-CIBA emphasized that finfish breeding technology requires scientific backstopping in form of breeding technology, feed development, fish health support and it is the team effort that helped in closing the life cycle of grey mullet after decades of research. He highlighted the importance of raising hatchery bred grey mullet juveniles into F1 broodstock to counter the biological challenge of a single narrow breeding window. Dr. M. Kailasam, Principal Scientist and Head-in-charge Finfish culture division explained that grey mullet farming is remunerative because of its high demand in domestic market with a price tag of ₹ 400-600/kg.

Progressive farmers Mr. A.M. Nizar and Mr. Purushothaman Thayambath from Kerala, Mr. T. Raghu Shekhar from Andhra Pradesh; Mr. M. Sathya from Tamil Nadu received the hatchery produced seed and admired the efforts taken by CIBA.

ICAR-CIBA initiatives on developing insurance support for shrimp aquaculture through novel insurance products

Shrimp farming accounts for more than 70% of Indian seafood export revenue and is an investment intensive farming activity with a high amount of risk, mainly due to the looming viral disease outbreaks and crop losses. However, adoption of better management practices, bio-security measures, and use of SPF shrimp seed, helped to tackle the disease issues in the Indian shrimp farming clusters. Institutional support in the form of bank credit and insurance would further support the farmers in adoption of good aquaculture practices and ensure sustainability of the production system. Insurance companies have been reluctant to provide insurance cover to shrimp farming during the last two decades assuming that it is a risky farming activity. ICAR-CIBA has been sensitizing insurance companies and facilitating them with scientific data that shrimp farming with adoption of better management practices is sustainable and needs institutional support, in the form of suitable insurance products. In this connection, CIBA organized a consultation meeting on 12th February, 2021 on developing a pragmatic crop insurance products for shrimp aquaculture. Officials from leading insurance companies, farmers, farmer representatives, scientists and other stakeholders participated in the deliberation. Dr. K.K. Vijayan, Director, CIBA, Chennai briefed the participants about the genesis and growth of Indian shrimp industry and the bloom-bust-sustainable phases the sector has witnessed and highlighted that institutional insurance is the need of the hour for shrimp farming and it would create a win-win situation for both insurance companies and farmers. During the interaction moderated by CIBA, members from Allianz Insurance Chennai, New India Assurance Chennai, ICICI General Insurance Chennai, and farmers and aqua business personnel exchanged their views on the draft proposal on insurance products for shrimp farming. The farmers expressed their requirements and assured that majority of the farmers would avail the insurance package. Shri. C.A. Srinivasan, Vice President, Allianz Insurance, stated that based on the outcome of the discussions on the insurance policy proposals, a pragmatic insurance policy could be worked out and subsequently the premium and other aspects would be discussed.

ICAR-CIBA conducted a special training programme for the Skilled Support Staff to enhance their work efficiency

Skilled Support Staff who help the scientists in their research and development activities seldom get attention and opportunities to enhance their skill sets. It is important that they also need to be heard and supported by conducting relevant capacity enhancement programmes. In this context, ICAR-CIBA, Chennai conducted a three-day special training course first-of-its-kind on "Enhancing the work efficiency of Skilled Support Staff" during 3rd to 5th, March 2021.

Fifteen skilled support staff attended the training. Dr. K.K. Vijayan, Director, CIBA who inaugurated the training programme underlined the importance of support staff and emphasized that their physical health and peace of mind are important for better performance in their workplace. Experienced trainers handled sessions on healthy lifestyle, yoga, and the importance of a balanced diet for maintaining good health.

International Women's Day celebrated at ICAR-CIBA

ICAR-CIBA celebrated International Women's Day with an emphasis on Women Leadership in Agriculture: Entrepreneurship, Equity & Empowerment (3E's) on 8th March 2021. About 40 participants, including women aqua farmers, women staff of ICAR-CIBA, attended the Women's Day celebrations held at Krishi Bhavan, New Delhi, wherein the Hon'ble Union Ministers of State for Agriculture and Farmers' Welfare, Shri. Parshottam Rupala and Shri. Kailash Choudhary, participated and greeted the women scientists, women entrepreneurs and farm women. In the post-lunch session, Dr. M. Bhanupriya, Consultant, Radiation Oncologist, gave a special talk on 'Women's Health Care', and Mrs. Gayathri Thiagarajan, Regional Nutrition Training Manager, Nestle India, presented a talk on 'The role of women in changing the nutrition of households'.

Dr. S.V. Alavandi, Director-In-Charge, highlighted the significant roles of women in the family and added that education alone emancipates women from the socio-economic clutches. Further, as a part of the fortnight-long Women's Day celebration, an event was organized on 27th February 2021 for women fish and shrimp farmers in Chennai.

ICAR-CIBA celebrated World Water Day – 2021

World Water Day is celebrated globally on 22nd March to sensitize the public about water and its availability, accessibility, depletion, efficiency, conservation, and management. ICAR-CIBA, Chennai, observed world water day on 22nd March 2021 by organizing a virtual seminar on "Sustaining Water for the Next Millennium". Dr. K.K.Vijayan, Director, CIBA highlighted the twin paradox of water, indicating that while freshwater is required for multiple purposes like drinking, domestic uses, irrigation, construction and aquaculture, its depletion is a significant concern. However, the brackishwaters, which can only be used for aquaculture. He also emphasised that it is the need of the hour to promote brackishwater aquaculture as a low water foot print food production system and sensitize the policymakers. Dr. Indumathi M. Nambi, Professor, Environment & Water Resources Engineering, Indian Institute of Technology, Madras, was the invited speaker during the celebration and delivered a lecture on 'Sustaining water for the next millennium'. In her presentation, she highlighted water footprint for green, blue and grey waters, individual and national water footprints, the concept of virtual water, water footprint import and export, and its impact on national trade policy.

Inauguration of trainees' hostel and live feed culture unit at KRC

CIBA has established a new trainees hostel in its KRC campus and named it as "Hilsa Trainees Hostel" for the accommodation of the trainees coming from different parts of the country. Dr. K.K. Vijayan inaugurated the "Hilsa Trainees Hostel" and "Live feed culture unit" at KRC on 3rd April 2021.

Interaction programme with farmers of Sundarban

An interaction programme with farmer beneficiaries from Sundarbans was organized on 3rd April, 2021 at KRC of CIBA wherein Dr. K.K. Vijayan, Director, CIBA handed over the cheques for revenue generated by the farmers in different demonstration programmes implemented under Tribal Sub-Plan (TSP) and Schedules Caste Sub-Plan (SCSP). He also distributed critical inputs *viz.,* milkfish seed, Poly*Plus* feed and Plankton*Plus* to the farmers as part of the programme. Apart from that he also distributed chicks to women farmers of Sundarban to have an additional income to improve their livelihood. During the interaction, he advised the farmers to use the cost effective technologies developed by CIBA to make aquaculture more profitable and sustainable.

Inauguration of the ornamental fish breeding unit developed by CIBA at Budhakhali village, Kakdwip

ICAR-CIBA has been working for the livelihood improvement of poor and backward farmers, particularly those belonging to the schedule caste (SC) and scheduled tribe (ST) in Sundarban, South 24 Parganas under NAIP, TSP, and SCSP programmes. As a part of the CIBA initiative, a Women Self Help Group (SHG) has been formed under the SCSP programme with 21 members. The SHG was named as "Budhakhali Sundari SC Fish Farmers Welfare Society" and is being mentored by KRC CIBA through hands-on training on fish keeping and breeding of ornamental fishes. Dr. K.K.Vijayan, Director, CIBA inaugurated the "Sundari Ornamental Fish Breeding Unit" established by CIBA on 3rd April 2021. During the inauguration, he requested the members of the group to play an active role in running the ornamental fish breeding unit to make it a model brackishwater ornamental fish hatchery at the village level. He directed the scientists to help the farmers group in establishing a marketing channel for the ornamental fish produced in the hatchery.

State of the art 'Aqua-Climate Laboratory' inaugurated by DDG (Fisheries) at ICAR-CIBA, Chennai

Dr. Joykrushna Jena, Deputy Director General (Fy), ICAR, virtually inaugurated the state-of-the-art laboratory on 27th April, 2021 at ICAR-CIBA, Chennai, in the presence of Dr. S.K. Chaudari, Deputy Director General (NRM), ICAR, Dr. V.K. Singh, Director, ICAR-CRIDA, Hyderabad, the coordinating Centre of NICRA project and Dr. K.K. Vijayan, Director, ICAR-CIBA. Dr. M. Muralidhar, Principal Investigator of NICRA project at ICAR-CIBA, briefed about establishing the Aqua Climate Laboratory facility under the National Innovations in Climate Resilient Agriculture (NICRA) project. Dr. K.K.Vijayan, Director, CIBA highlighted that the partnership between CRIDA and CIBA, in the area of climate change research, has resulted in the development of a facility of international standards. He also thanked ICAR for its funding support in establishing the facility.. Dr. V.K. Singh, Director, CRIDA applauded CIBA for the achievements under the NICRA project and completing the facility within the stipulated time. Dr. J.K. Jena congratulated CIBA for this excellent facility in the region and emphasized the importance of aquaculture for food security in the scenario of climate change. The laboratory is housed with state-of-the-art equipment *viz.,* Greenhouse gases analyzer, CHNS analyzer, Carbon fractions analyzer (TOC, IC, and TC), Ion Chromatograph, Cyclic Voltammeter, Kjeltec Nitrogen digestion and distillation system, *etc.* for the research related to aquaculture and climate change.

INTER-INSITUTE TRANSFERS

Sl.No	Name	Designation	Transferred to	Date
1	Ms. M.U.Rekha	Scientist	PMFGR-ICAR-NBFGR, Cochin Centre	30.01.2021
2	Dr. K.C. Neethu	Scientist	ICAR-IISR, Kozhikode	11.02.2021
3	Dr. Gouranga Biswas	Senior Scientist	ICAR-CIFE, Kolkata Regional Station	30.01.2021

PROMOTION

Sl.No	Name	Designation	Date
1	Smt. E. Amudhavalli	Assistant Administrative Officer	21.01.2021
2	Shri. A. Sekar	Assistant Administrative Officer	19.03.2021
3	Shri. V. Kishorkumar	LDC	22.03.2021
4	Shri. Sanjoy Some	LDC	20.03.2021

SUPERANNUATION

Sl.No	Name	Designation	Date
1	Shri. U.K. Santra	Skilled Supporting Staff	31.01.2021
2	Shri. S.K. Bindu	Assistant	28.02.2021
3	Shri. A. Manoharan	Assistant Administrative Officer	31.03.2021
4	Dr. S.V. Alavandi	Principal Scientist	30.04.2021
5	Dr. K.K. Vijayan	Director	31.05.2021

VOLUNTARY RETIREMENT SERVICE

Sl.No	Name	Designation	Date
1	Shri. S. Pari	Assistant Administrative Officer	01.03.2021

ICAR-CIBA IN NEWS

Now, crop insurance for shrimp farmers

SV KRISHNA CHAITANYA @ Chennai

THE Chennai-based Central Institute of Brackishwater Aquaculture (CIBA) is working on modalities to introduce crop insurance for shrimp farmers who are highly vulnerable to suffering total losses.

A consultation meeting was recently organised at CIBA to develop a pragmatic crop insurance product for shrimp aquaculture. Officials from leading insurance companies, farmers, farmer representatives, scientists and other stakeholders participated.

KK Vijayan, director, CIBA told Express, "The shrimp farming industry in India has transformed from a traditional fishing system to a capital oriented semi-intensive system. Availability of large areas of suitable coastal land has led to a phenomenal growth of this industry. Official statistics show shrimp farming accounts for about 70 per cent of Indian seafood exports revenue to the tune of ₹35,000 crore.

"However, it is an investment intensive and risk laden farming activity. After white spot disease caused extensive damage globally in 1994 and The Marine Products Export Development Authority (MPEDA) declared crop holiday in 1996, there hasn't been any insurance cover for shrimp farmers," Vijayan said. Adoption of better management practices, bio-security measures including aquatic health management and use of Specific Pathogen Free (SPF) shrimp seeds, helped to tackle the disease issues in the Indian shrimp farming clusters. Institutional support in the form of bank credit and insurance would further support the farmers in adoption of good aquaculture practices and ensure sustainability of the production system," Vijayan argued.

Insurance companies have been reluctant to provide insurance cover to shrimp farming assuming that it is a risky farming venture. "CIBA has been sensitizing insurance companies and facilitating them with scientific data that shrimp farming with adoption of better management practices is sustainable and needs institutional support," the official said.

T Ravisankar, principal scientist from Social Sciences Division, CIBA, said institutional insurance was the need of the hour and it would create a win-win situation for both insurance companies and farmers.

THE NEW INDIAN EXPRESS

Now, local tech to captive-breed grey mullet fish

Developed by Chennai's CIBA, technology is now ready for large-scale aquafarming

SV KRISHNA CHAITANYA
@ Chennai

IN a major breakthrough, Central Institute of Brackishwater Aquaculture (CIBA) has successfully captive breed ... hibiting fast growth rates. The species is an ideal candidate for Polyculture and Integrated Multi-trophic Aquaculture systems. Considering its significance in brackish...

CIBA achieves breakthrough in captiv breeding of grey mullet fish

Grey mullets are preferred for their taste, texture, less spines and nutritive

The first batch of hatchery produced grey mullet seeds were distributed to four farmers recently.

The Fish Site

Breeding & genetics | Farm management | Health & welfare | Nutrition | Envi | All sections

Could an Indian breakthrough lead to a grey mullet farming boom?

BREEDING & GENETICS

by Amod Salgaonkar
1 February 2021, at 1:23pm

The first commercial-scale hatchery-produced grey mullet to have been produced in India have now been sent out to fish farmers in three states.

5/19/2021

Home › Cities › Chennai

Chennai-based CIBA develops India's first vaccine for killer virus targeting fish

Scientists say the VNN disease is a serious threat affecting many marine, brackishwater and freshwater fish causing up to 100% mortality in larval and early juvenile stages

Share

Published: 29th April 2021 02:03 PM | Last Updated: 29th April 2021 02:03 PM

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The vaccine was developed under the consortium research platform on vaccines and diagnostics. (Photo | Special Arrangement)

By SV Krishna Chaitanya

5/19/2021 CIBA releases first indigenous vaccine for fish - The Hindu

THE HINDU

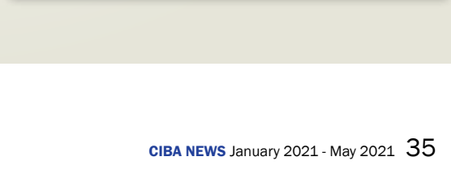
TAMIL NADU

CIBA releases first indigenous vaccine for fish

SPECIAL CORRESPONDENT

CHENNAI, APRIL 29, 2021 01:05 IST
UPDATED: APRIL 29, 2021 01:05 IST

Nodavac-R is safe and can be injected to fingerlings, says expert



Printed from THE TIMES OF INDIA

Chennai-based researchers develop tech for captive breeding of red snapper fish

TNN | May 26, 2021, 05.00 PM IST

CHENNAI: Researchers at ICAR-Central Institute of Brackishwater Aquaculture (CIBA) have developed a seed production technology for captive breeding of mangrove red snapper, which is a highly sought after fish for consumption among consumers.

According to CIBA researchers, the technology opens up scope for the country's brackishwater aquaculture ventures in the near future.

In a release, CIBA said due to its excellent meat quality and taste, red snapper has a very high consumer preference and a consistent demand from the consumers provides a stable market price in the range of Rs 400 and Rs 600 a kg. The institute took five years of research to develop the technology for the fish, which is locally known as seppili in Tamil and chembally in Malayalam.

“Brackishwater aquaculture for food, employment and prosperity”

Shri. Giriraj Singh, Hon’ble Union Minister interacting with the Director and other delegates at Muttukadu Experimental Station of ICAR-CIBA

ICAR-Central Institute of Brackishwater Aquaculture

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