

CIBANEWS



भाकृअनुप - केन्द्रीय खारा जलजीव पालन अनुसंधान संस्थान
ICAR - CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE
ISO 9001:2008



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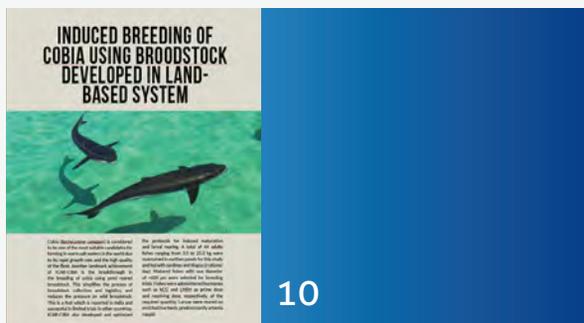
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Relaunching of ICAR - CIBA Newsletter

The institute is reviving the publication of newsletter.

Special Issue on research highlights & achievements of 2010 - 2015.

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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 Rs 10,000 crore annually.

AQUACULTURE

IS INCREASINGLY RECOGNIZED AS THE BEST OPTION TO MEET THE GROWING DEMAND FOR FOOD



FROM THE DIRECTOR'S DESK

Aquaculture now accounts for half of the world's total supply of food fish, and it is widely recognized that it would be a major food factory which can meet the increasing protein and other nutritional requirements of man in the future. Farming in brackishwater is a rapidly growing agribusiness enterprise in coastal areas and inland salt affected lands of India, contributing to employment generation, poverty alleviation, community development, food security and to export. In brackishwater farming, footprint of fish production on potable water is zero. Therefore much of the expansion in aquaculture is expected to occur in these environments.

Although aquaculture is centuries old with a rich history in many Asian countries. There was a drive since 1980 towards non-traditional high valued export oriented aquaculture, including in India. More specifically, shrimp aquaculture is cited as a recent example of a paradigm shift. Owing to the high export demand, shrimp has become the focus of brackishwater aquaculture and production has risen from about 20 t in 1970 to 3.53 lakh t in

2015, contributing a major share of the seafood export earnings. With considerable resources of brackishwater along coastal states and inland saline areas, the scope and expansion of brackishwater aquaculture in India is highly promising. While acknowledging the economic benefits and employment opportunities provided by the shrimp farming sector, it is essential to recognize the skewed growth around a single species of exotic vannamei shrimp, and ICAR-CIBA realize the risk of complete dependence on imported SPF broodstock. Therefore, we continue to stress upon the diversification of brackishwater aquaculture with different candidate species of shellfish and finfish to judiciously and responsibly utilise the brackishwater resources in the country in a sustainable manner with broad stakeholder participation.

In this direction, ICAR-CIBA has made commendable progress in the multi-disciplinary areas of brackishwater farming covering captive seed production, feed development, farming system development, disease diagnostics

and health management, genetics and stock characterisation, climate smart aquaculture, community engagements using social science tools and policy interventions through government agencies etc. Cumulatively, these R&D interventions from ICAR-CIBA have opened up new diversified farming initiatives and strategies to support the ongoing shrimp farming. Our ultimate goal is achieving sustainable brackishwater aquaculture for food, employment and prosperity. It is encouraging to see the tremendous support from the farmers, industry people and government agencies for our efforts. I would like to take this opportunity to thank all those who have rendered support in the past and we expect it to continue forever. On this occasion, ICAR-CIBA feel pleased to revive our biannual Newsletter "CIBANEWS" and this is the 1st special issue which brings to you our landmark achievements in the last five years (2010-2015). We are certain that this issue would be enriching and interesting to the readers.

Dr. K.K. Vijayan
Director



EXOTIC VANNAMEI SHRIMP: A BOON FOR INDIAN SHRIMP FARMING

ICAR-CIBA'S INTERVENTION IN ITS INTRODUCTION AND FARMING

Before the year 2008, India's brackishwater aquaculture was centered around the black tiger shrimp as the single most species. Although tiger shrimp based aquaculture provided spectacular growth in farmed shrimp production, later, the sector experienced severe setbacks due to viral epidemics and subsequent crop failures. It has been widely realized that an undomesticated wild stock cannot support a successful farming industry beyond a limited period.

In the year 1989, US Marine Shrimp Farming Program (USMSFP) developed the first population of specific pathogen free (SPF) *P. vannamei*, and it was successfully introduced in many South East Asian countries later. Perceiving the performance of selectively bred SPF vannamei, Indian farmers also wanted to import SPF vannamei. Subsequently, in the year 2009, GOI (DAHDF) decided to import selectively bred, SPF vannamei from the western world. The Govt. of India granted permission to two private firms for importing specific pathogen free (SPF) broodstock of *P. vannamei*

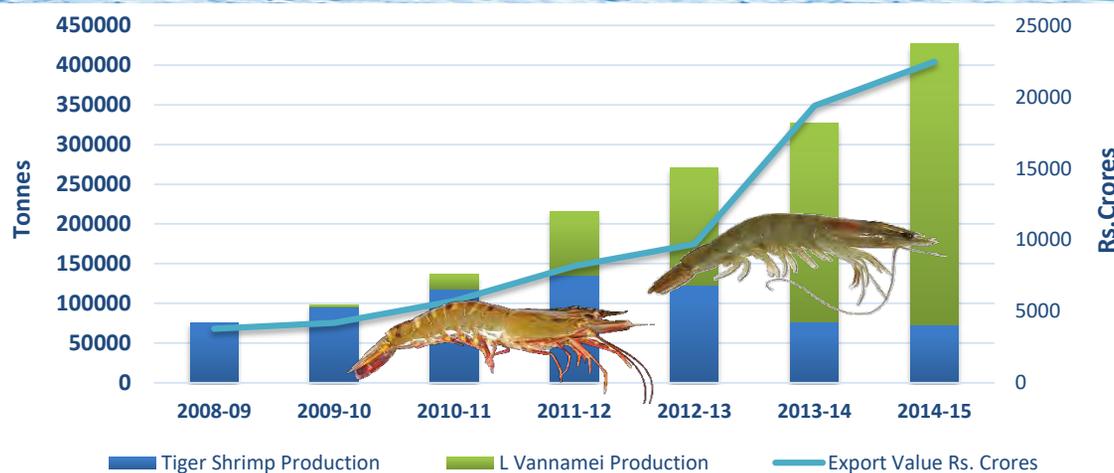
from Hawaii for pilot scale experimentation. The Ministry of Agriculture, Govt. of India, then constituted a committee including ICAR-CIBA Chennai & ICAR-NBFGR, Lucknow, to conduct an Import Risk Analysis for the large-scale importation of white-legged shrimp, *P. vannamei* to India. CIBA played a crucial role and carried out the study, which involved the review of pilot-scale importation and culture of *P. vannamei* by the two licensed firms, review of the status of *P. vannamei* culture in southeast Asian countries, the status of the biosecurity in Indian shrimp farms through rapid survey in the progressive states of Andhra Pradesh and Tamil Nadu, Import Risk Analysis, and formulation of regulatory framework for the low-risk scenarios. Considering the experiences in pilot scale introduction, The Govt. of India approved the large scale introduction of *P. vannamei* in the country under effective monitoring and regulations by the Coastal Aquaculture Authority, Chennai.





ROLE OF ICAR-CIBA

- Risk and impact analysis jointly done with ICAR-NBFGR
- Framed the import guidelines and Best Management Practices (BMP)
- Technical support to Coastal Aquaculture Authority (CAA) for creating the quarantine facility
- CIBA has played a vital role in allaying fears of the presence of shrimp disease, Early Mortality Syndrome (EMS), which caused severe economic loss across the shrimp farming nations of the world. CIBA along with other linkage partners in state and central government bodies, academic institutes in invalidating the outbreak of EMS in India. This helped to achieve a present production of about 3.35 lakh tons and export value of 20,000 crore.
- CIBA as a referral laboratory for screening OIE listed aquatic animal pathogens including emerging pathogens such as acute hepatopancreatic necrosis disease (AHPND) and Enterocytozoon hepatopenaei (EHP) and involved nationwide surveillance of shrimp diseases.
- CIBA developed a cost effective indigenous shrimp feed for vannamei and commercialised it on PPP mode to stakeholders in various coastal states of this country to serve as benchmark on the performance as well as pricing the feed.
- Continuing research related to water and soil quality (water and soil health card), intensification of culture system (biofloc based nursery) etc.



Impact of vannamei introduction on Indian shrimp production





IMPACT OF VANNAMEI INTRODUCTION ON INDIAN SHRIMP PRODUCTION

The area under shrimp farming in India increased considerably from 283 ha in 2010 to 50,000 ha in 2015, and is expected to increase further in the coming years. At present, there are 276 organized hatcheries, 14 nauplius rearing centers and 24 hatchery consortiums in place to meet the vannamei shrimp seed requirement in the country. About 160,000 people are directly and 350,000 people

indirectly employed in the shrimp farms and hatcheries. The total shrimp export from India increased from 1.3 lakh tonne in 2010 to 3.73 lakh tonne in 2015, contributing a major share in seafood export by value. The export earnings from frozen shrimp alone increased from Rs. 4000 crores in 2010 to Rs. 20,000 crore in 2015.





ASIAN SEABASS SEED PRODUCTION AND FARMING TECHNOLOGY

India, being a tropical country with rich of diversity in aquatic species and water resources, is essential to diversify the farming for judicious utilization of resources. Asian seabass, *Lates calcarifer*, is a fast growing, high value carnivorous fish, which can be farmed in wide range of salinities. By fetching higher price in domestic and export markets, it is an ideal candidate for farming. The standard table size is 500 g to 3 kg, it can grow up to a size of 200 cm long and 60 kg weight. It is a prime candidate species suitable for cultivation in brackishwater ponds, cages and Re-circulatory Aquaculture Systems (RAS). Adequate supply of quality seed is a bottle neck in the expansion of seabass farming. In nature, breeding season of this species is restricted to 4 months in a year (July to October). Considering

its biological and culture potential, ICAR-CIBA made a breakthrough in induced breeding and perfected year round breeding of seabass under captive condition in 1997. Successful spawning has been achieved for extended periods of up to 10 months in a year (June – November & Feb - March) either by spontaneously or by inducing with hormones. Thus, ICAR-CIBA perfected the seed production protocol, which has been able to produce up to 2 million seeds a year. The produced seeds are distributed to farmers across the country for further rearing. This technology is being transferred as a package (on non-exclusive basis) to government and private enterprises to promote establishment of hatcheries in different geographical locations of the country to cater the seed demand.



DEMONSTRATION OF ASIAN SEABASS FARMING

To popularize the seabass farming and to educate the farmers on various aspects of farming, the institute has taken up several demonstration programs in the past five years with the financial assistance of NFDB, and successfully demonstrated the technical feasibility and economic viability of seabass farming. All the demonstration programs were carried out in farmer's ponds in different States of the country such as Andhra Pradesh, Tamil Nadu,

Karnataka, Maharashtra, Odisha and West Bengal using formulated pellet feeds developed by ICAR-CIBA. The demonstration involved hapa based nursery rearing and pond based pre-grow out and grow out culture. To sensitize the fish farmers on seabass farming, various interaction meetings and workshops were conducted at all the demonstration sites to showcase the technology.





IMPACT OF THE COMPREHENSIVE SEABASS TECHNOLOGY

The breakthrough achieved in captive breeding of seabass was further fine-tuned, and achieved a seed production capacity of about 4 million seabass seeds per annum together with the technology recipient RGCA, MPEDA. This has promoted seabass farming extensively in West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka and Maharashtra in a total area of 4000 to 5000 ha including freshwater regions, with an estimated production of 8,000 to 10,000 tons worth Rs. 200 crore. Further, about 20,000 people are directly employed in the various farming activities, and another 10,000 people are

involved in allied sectors of seabass farming.

ICAR-CIBA signed MoU with the Kerala University Fisheries and Ocean Studies (KUFOS), Kochi for conducting joint research for development of a sustainable model of brackishwater aquaculture in Kerala State at the Fisheries Research Station, Puthuvypu island on 15th March 2015.

Seabass hatchery production technology was transferred to a farmer entrepreneur in Krishna Dt, Andhra Pradesh, during 2010 and M/s Suryo foods, Bhubaneswar, Odisha during 2013.



TRANSFER OF TECHNOLOGY AND COMMERCIALIZATION



- ☞ In 2012 Hatchery technology was transferred to Sankar Rao Hatcheries, Andhra Pradesh.
- ☞ In 2013 Hatchery technology was transferred to M/s Suryo foods.
- ☞ Nursery rearing and grow-out farming techniques of seabass were extensively transferred to several small farmer groups and entrepreneurs in all the maritime states.

INDUCED BREEDING OF COBIA USING BROODSTOCK DEVELOPED IN LAND-BASED SYSTEM



Cobia (*Rachycentron canadum*) is considered to be one of the most suitable candidates for farming in warm salt waters in the world due to its rapid growth rate and the high quality of the flesh. Another landmark achievement of ICAR-CIBA is the breakthrough in the breeding of cobia using pond reared broodstock. This simplifies the process of broodstock collection and logistics, and reduces the pressure on wild broodstock. This is a feat which is reported in India and successful in limited trials in other countries. ICAR-CIBA also developed and optimized

the protocols for induced maturation and larval rearing. A total of 44 adults fishes ranging from 3.0 to 25.0 kg were maintained in earthen ponds for this study and fed with sardines and tilapia (2 rations/day). Matured fishes with ova diameter of $>600\ \mu\text{m}$ were selected for breeding trials. Fishes were administered hormones such as hCG and LHRH as prime dose and resolving dose, respectively, of the required quantity. Larvae were reared on enriched live feeds, predominantly artemia nauplii.





Comprehensive hatchery and farming technology for potential shrimp species

At present Indian shrimp farming is centred around exotic vannamei as a major brackishwater aquaculture crop. There always a risk in vannamei farming due to emerging diseases, monopoly by overseas broodstock suppliers and unsteady export market. ICAR-CIBA has visualize the need for diversification of shrimp

species. ICAR-CIBA has standardised hatchery seed production and farming technologies for five shrimp species including vannamei. The Institute is committed to put the technologies in place to ensure the sustainable production of valuable shrimp in this country.



The Institute has carried out significant scientific research and efforts to improve the hatchery production of penaeid shrimp seeds since its inception. Successful breeding and seed production of tiger shrimp *P. monodon* was achieved first at the experiential hatchery at Muttukadu, Chennai. Subsequently, under diversification of the species programme, the life cycle of Kuruma shrimp and Indian white shrimps were closed within the hatchery, and produced up to F6 generation. Another milestone was identification of new geographical location of banana shrimp at Adirampattinam in Tamil Nadu, and seed production and

culture feasibility of this species were demonstrated in Danti, Gujarat, Kakdwip, West Bengal and Tamil Nadu.

Over the years ICAR-CIBA developed better management protocols in breeding and seed production of all the four species of native shrimp and the exotic vannamei shrimp. Later we also started focussing on generating a base line data for selective breeding of penaeid shrimp, particularly for indigenous species, Indian white shrimp. Considering the uncertainties in exotic vannamei farming and the risk of complete dependence on imported SPF broodstock, ICAR-

CIBA visualizes Indian white shrimp as the potential alternative shrimp species for Indian shrimp farming. We also focus on intensive eco-friendly rearing models for sustainable shrimp production. Biofloc based shrimp rearing systems have been found to be cost effective and help the shrimps to improve their immune system. CIBA had its first pilot shrimp hatchery at Muttukadu in 1996, with production capacity of 10 million seeds/annum. Until today this hatchery is in full swing operation and has facilitated the development of hatchery technology for all this five shrimp species. With the technologies developed and the R&D capabilities ICAR-CIBA guided many hatcheries/farmers in the past 2 decades through technology partnerships and consultancies.



Tamil Nadu State Govt. participants during the sensitization workshop

STATE LEVEL SENSITIZATION WORKSHOPS ON INTRODUCTION AND FARMING OF *PENAEUS VANNAMEI* IN INDIA

State level sensitization workshops for the Fishery Extension Officers of the Department of Fisheries, Govt. of Gujarat, Andhra Pradesh and Tamil Nadu were organised respectively on the 6th, 20th and 28th July, 2010 on the "Introduction and farming of *Penaeus vannamei* in India" at Baruch, Gujarat; Kakinada, Andhra Pradesh and CIBA, Chennai. A 'Handbook on seed production and farming of *P. vannamei*' was prepared incorporating the risk analysis for introduction of *P. vannamei* in India, guidelines for import of brood stock, seed production and farming of SPF *P. vannamei* and responsible use of drugs in aquaculture.





Highlights

- Farming technologies extensively demonstrated in farmers ponds across the country
- Hatchery technology for: Tiger, Indian white, Banana, Kuruma and Vannamei
- Farming technologies in diversified systems: ponds/ Integrated Multi - Trophic Aquaculture (IMTA)/ Biofloc/ RAS etc.
- Captive maturation and genetic selection
- Indigenous feed technology for nursery/grow-out/maturation
- Water quality and environmental monitoring and advocating remedies
- Disease diagnosis and monitoring; referral lab for screening OIE listed pathogens



THREE TIER FARMING SYSTEM OF MUD CRAB

Mudcrabs are high valued species for diversification of Brackishwater aquaculture. Constraints in seed production and long duration of grow out production are the major bottlenecks in mud crab culture.

A three tier modular farming system comprising three months nursery rearing, four months of mid grow-out and three months of final grow-out system is found to be a sustainable model to reduce the culture duration

and optimization of economy. Thus three tier modular farming system comprising nursery rearing (0.01 g to 85 g size in three month), mid grow-out (85 g to 280 g) and final grow-out system (280 g to 430 g) have been developed. This form of modular production system found to enhance the survival rate and production efficiency, and farmers would be able to get a profit within three to four months.

ORGANIC TIGER SHRIMP FARMING

Disease risks, increasing cost of production and environmental issues threaten the sustainability of shrimp farming. This necessitates the development of eco-friendly farming models like organic shrimp farming adopting certified organic standards. Low input shrimp farming based on organic principles with low stocking and using all organic inputs was successfully developed and demonstrated in three year field trials with *P. monodon*.

The organic produce from these sustainable models has a niche in the international market due to its premium price, and are getting popular as consumers are more environmentally aware

and concerned about food safety. Hence, in concurrence with the farmer first policy, a sustainable method of low cost low input shrimp culture was carried out in growout ponds at the Kakkwip Research Centre of CIBA, Kakkwip for easy adoption by shrimp farmers. This technology relies on the natural productivity that serves as an additional high quality natural food with zero tolerance to chemotherapeutic agents and antibiotics.

Organic shrimp culture adopting the certified organic procedures and organic feed technology developed by CIBA yielded a productivity of 2.8 t/ha. These technologies yielded constructive

gain in production up to 27.32%, size at harvest to 17.5% and FCR to 22.30% with an assured happiness index to the farmers compared to the conventional farming systems. The cost of production was also significantly lesser up to 17 to 18% than the conventional semi intensive farming. The technology has been adopted by farmers in Kerala and West Bengal to produce premium priced shrimp. The produce is certified as per INDOCERT organic standards for export.

The organic shrimp feed and farming technology has been commercialized to Jass Ventures (P) Ltd., Ernakulam, Kerala in 2013





INDIGENOUS SHRIMP FEED TECHNOLOGY

Farmed shrimp constitutes about 70% of the annual seafood exports from India. Feed being a critical input in shrimp farming, this not only determines the growth performance of the shrimp, but also a key factor related to the cost of shrimp production and sustainability.

Formulated feed is a major recurring cost, which often ranges from 50 to 60 % of the total cost of production and directly determine the profitability. In the beginning, Indian shrimp farming sector was completely dependent on either imported feed (85%) or feed manufactured in India (15%) by a few overseas companies. The major share of Indian shrimp feed business is catered to by multinational corporate companies or their joint ventures, where an upward trend in price has been

noticed. This was a bottleneck for the expansion of shrimp farming in India. Visualizing this as a critical obstacle, ICAR-CIBA developed, tested and commercialized an indigenous feed manufacturing technology as pioneer in India. ICAR-CIBA's focussed research on nutrient requirements, scientific feed formulation, database on price and seasonality of locally available ingredients led to a cost effective shrimp feed using indigenous feed manufacturing technology. CIBA's technology was competent enough to process quality compressed pelleted feed using ring die pelletizers, which also were manufactured indigenously. As a package, this technology involves, establishing the feed mill, formulation, periodical auditing of the formula, the process of feed manufacturing and evaluation of the processed feed.

Highlights of the expertise / technology

- ❧ Compressed pelleted feed using ring die pelletizers
- ❧ Indigenous machineries.
- ❧ Technology package involves, establishing the feed mill, formulation, periodical auditing of the formula, the process of feed manufacturing and evaluation of processed feed.
- ❧ Uses low cost locally available ingredients.
- ❧ Cost effective customizable formulation.
- ❧ Optimum in meeting the processing needs and shrimp nutrient requirements.
- ❧ Suitable for all the life stages of shrimps in different particle sizes.
- ❧ Extensively field tested and demonstrated





The feed technology developed by ICAR-CIBA was transferred to M/s Bismi Feeds Ltd., Tamil Nadu on non exclusive basis. M/s Bismi Feeds built a feed mill with capacity of 1 ton/hour and 3000 tons/ annum with a total investment of Rs. 2.5 crores. The feed was officially launched on 11-10-2008 and distributed to the farmers. Between 2008 & 2011 they have produced around 7200 tonnes of feed and paid Rs. 3.64 lakhs as royalty to ICAR-CIBA @ of 5 paise /kg feed sold. After the launch of the indigenous feed with technological assistance from CIBA, the visibility of the institute also improved manifold in the farming community and other stakeholders in the sector. The market share of Bismi Feeds reached about 12% of the tiger shrimp feed sold in Tamil Nadu during the year 2011-12 and it continues to grow further and it is becoming the most sought after feed. Although the CIBA technology recipient (M/s Bismi Feeds) was able to meet only 2 to 3% of the total needs of the country, it has served as a benchmark for determining pricing as well as quality of the other commercial feeds available in the Indian market.

Consultancy services on establishment of feed plant and machineries and feed processing technology were made with Shri. Ram Baboo Goenka, Kolkata in 2013; M/s Laxmi Narayan Feeds, Balasore, Odisha in 2013; M.K.Feeds (Pvt.) Ltd., Kolkatta in 2014; Poshak Bio Research Pvt Ltd, Anand, Gujarat in 2015.

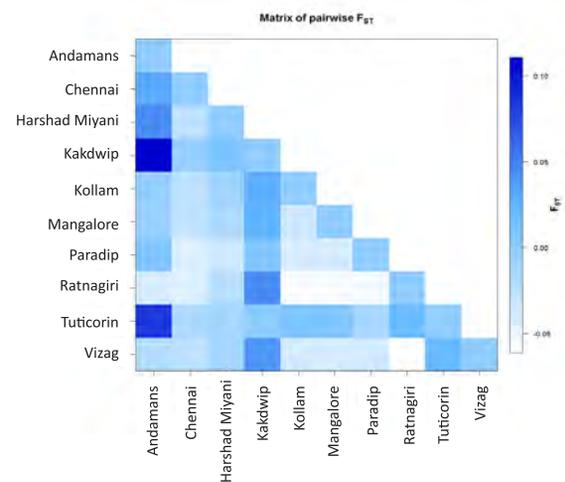
MoU on development and improvement of *P. Vannamei* feed was signed with The Waterbase Ltd., Chennai during 2012.



Genotyping of TIGER SHRIMP

Transcriptome sequencing using Illumina RNA-seq was performed to characterize populations of black tiger shrimp from India. Samples were collected from four landing centres along the east coast of India, survivors of a severe WSSV infection during pond culture and the Andaman Islands. The transcriptome data generated was used to identify a large number of putative SNPs and indels within transcribed genes a high-density genetic map containing about 4000 of these SNPs was produced using a custom Illumina iSelect genotyping array. The array was developed for the first time globally by ICAR CIBA-DBT-NOFIMA for genotyping purpose in tiger shrimp. De novo transcriptome assembly resulted in 136,223 contigs with a total length 61 Mb, an average length of 446 bp and an average coverage of 163 X across all pools approximately 16% of contigs were annotated with BLAST hit information and gene ontology annotations. A total of 473,620 putative SNPs/indels were identified. An Illumina iSelect genotyping array containing 6,000 SNPs was used to genotype 1024 offsprings belonging to seven full-sibling families. A total of 3959 SNPs were mapped to 44 linkage groups. This approach has

substantially increased expressed sequence and DNA marker resources for tiger shrimp and is a useful resource for QTL mapping and association studies for evolutionary and commercially important traits. The mapped SNPs will therefore be a useful resource for scanning the tiger shrimp genome for markers affecting economically important traits for aquaculture. Marker assisted selection using SNPs closely linked to QTL affecting these traits, or genomic selection using the complete set of SNPs identified, could speed the rate of genetic improvement for such traits in the future.



Industry opinion

Role and need of aqua professionals



Aquaculture, unlike other animal husbandry disciplines, is one of the most dynamic and challenging activities. This is simply due to the fact that everything in aquaculture, be it feed consumption, population, even the size or weight of the animals reared can only be estimated, may be to a greater level of accuracy by experienced aqua farmers. Aquaculture relies on science to a great extent; at the same time it was and is also an art which necessitates the use of intuition, experience and imagination along with scientific principles.

New pathogens evolve every day. Many of them are endemic in all waters. Problems related to climate, ageing of ponds, inbreeding suppressions pop up regularly. Effective

To achieve sustainable crops one need to have a long-term perspective, setting aside the lure of short-term gains.

administration of therapeutic agents and vaccines is virtually impossible in aquaculture. On many occasions farmers tend to take models of treatments from other husbandry practices to counter the problems faced without much of the expected success rates. To give an example, shrimp farmers used/use antibiotics to treat mortalities caused by pathogenic bacteria without realizing the futility of their action, more like treating the symptoms without diagnosing the underlying cause.

To achieve sustainable and successful aquaculture crops one needs to have a long-term perspective, setting aside the lure of short-term unsustainable gains. This is where professionalism comes in. Some of the issues plaguing the shrimp farming sector in India are use of pond-reared brood stock for producing seeds, wrong crop planning, poor pond preparation, etc.

Most mortalities observed in shrimp farming is often found to be associated with poor bio-security measures adopted or bad management and crop planning on detailed analysis. We cannot have a generalized approach in aquaculture as conditions vary from pond to pond and area to area. On many occasions, greed rather than need takes over. These are instances when and where a qualified and experienced professional can make a difference. He is there to help out farmers/hatchery operators/feedmillers/processors/input suppliers in identifying the problems and giving the right suggestions, so that aquaculture sustains as well as prospers and leaving it in healthy condition to our future generations too. Currently, there is a severe shortage of qualified manpower, particularly in the field of aquaculture, with very few fisheries and marine biology courses in the country bringing out students who are ready to work in this evergreen field. We appeal to several of the institutions under ICAR to give a serious thought about running more courses on Fisheries/Marine biology/Aquaculture/Mariculture and support the sector. Everyone can't become an Engineer or a Doctor, after all.....!!

Mr. Muthukaruppan
President, SAP Chennai



Aquatic Animal Health

National Referral Laboratory for Brackishwater Aquatic Animal Diseases

CIBA's Aquatic Animal Health (AAH) laboratory has been providing pathogen testing services as a referral laboratory for screening aquatic animal pathogens. The laboratory is one of its kind in the whole country for screening aquatic animal pathogens using Level-III diagnostics. The laboratory has acquired capacity in diagnosing all OIE listed aquatic animal pathogens including emerging pathogens of shrimp such as Acute Hepatopancreatic Necrosis Disease (AHPND) and *Enterocytozoon hepatopenaei* (EHP), and other finfish pathogens such as viral Nervous Necrosis (VNN) and Iridovirus, employing the latest molecular diagnostic tools.

NRL-BAAD provides valuable services to various agencies such as Animal Quarantine and Certification Services, Southern Region (AQCS-SR), Chennai, Aquatic Quarantine Facility (AQF), Rajiv Gandhi Centre for Aquaculture (RGCA), for screening imported artemia cyst samples and *P. vannamei* brooders under quarantine.

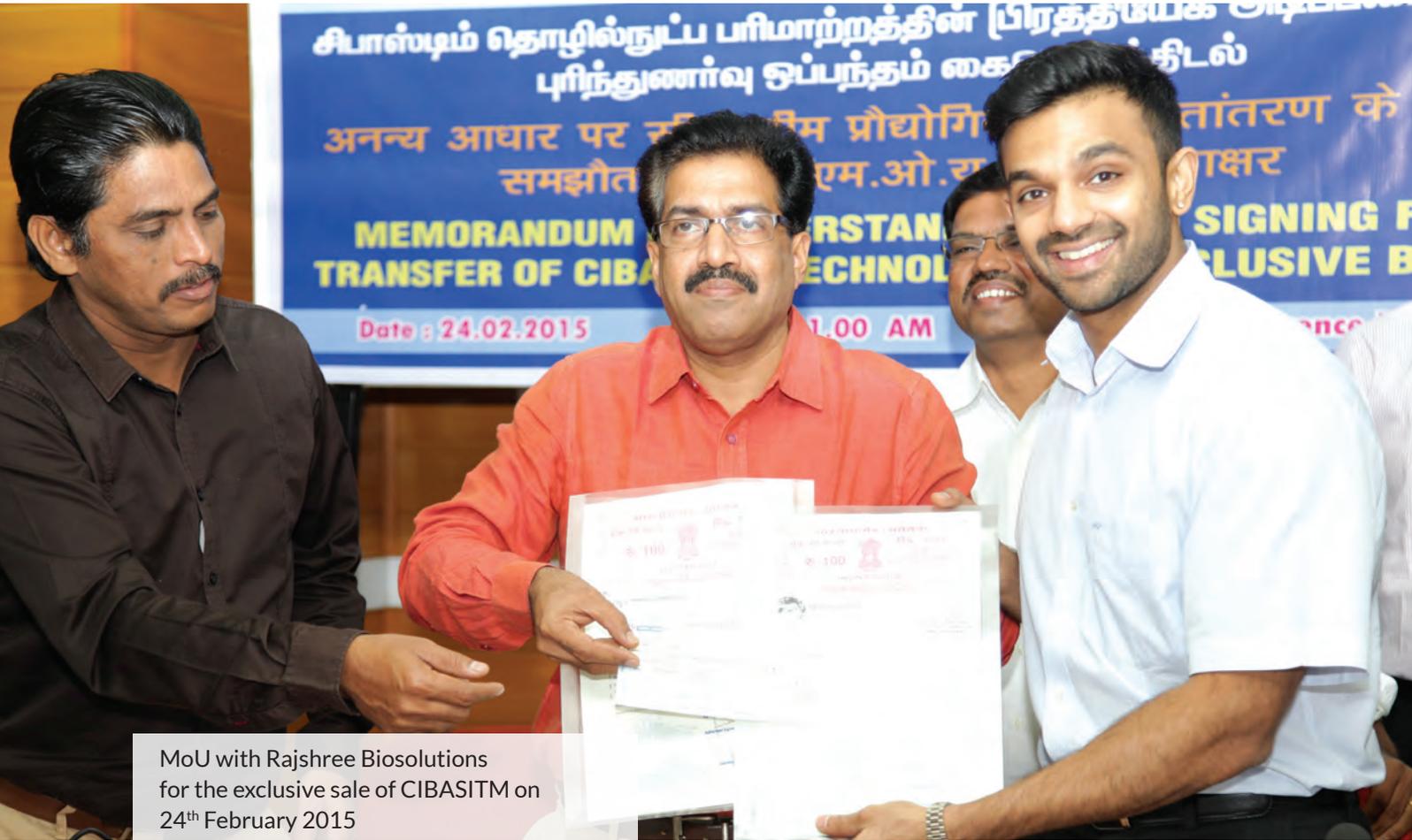
Viability and transmission of white spot syndrome virus in brackishwater environment

The white spot syndrome virus (WSSV) has been found to survive for 12 days in seawater, 19 days in pond sediment despite sun-drying, and for 35 days under non-drainable pond conditions. This information is highly useful for the improvement of BMPs, especially with regard to pond preparation protocols. WSSV could be transmitted to shrimp from infected crabs by cohabitation and oral feeding and also could be transmitted vertically in

Development of Diagnostic tools

- Methodology was developed for the concentration of viruses in water by ultrafiltration to enable WSD detection by PCR and enumeration by quantitative real time PCR.
- A SYBR Green based real time polymerase chain reaction (PCR) assay was developed for the detection of *Monodon baculovirus* (MBV), which can detect as low as 12 copies indicating that the assay was sensitive and could be effectively used for the quantification of MBV.
- VP28 antibody based immunodiagnostic test was developed for the detection of WSSV.





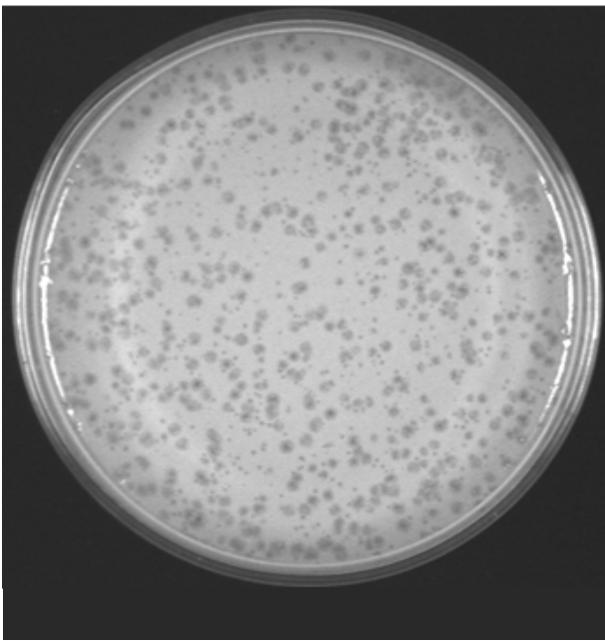
MoU with Rajshree Biosolutions for the exclusive sale of CIBASITM on 24th February 2015

- An improved diagnostic nested RT-PCR with custom designed primers targeting RdRp gene of Laem-Singh Virus (LSNV), implicated in monodon slow growth syndrome (MSGs) was developed.
- A reverse transcriptase polymerase chain reaction (RT-PCR) diagnostic tool for the rapid diagnosis of betanodavirus infections responsible for viral nervous necrosis (VNN) in the seabass farms was also developed.

Scylla spp., as revealed by detection of low level viral load in the ovarian tissues by RT-PCR.



The immunostimulant product 'CIBASTIM' has been commercialized to M/s Rajshree Biosolutions, Theni, Tamil Nadu on exclusive basis for a period of three years in 2013 and later shifted to non-exclusive basis from 2015 for a period of five years.



Brackishwater

a climate friendly aquatic food production system



Optimisation of shrimp aquaculture development

The institute conducted scientific investigations on the estimation of carrying capacity (CC) of water bodies with respect to shrimp farming based on the maximum nutrients loading which can be assimilated by the water body without exceeding the permissible levels of water quality as per the regulations of Coastal Aquaculture Authority and flushing /dilution rates, and the supportive capacity of the ecosystem. Software was developed for recommendation of the area for shrimp aquaculture based on the carrying capacity. The purpose of the software is to give recommendations on the area to be taken up for culture on a particular water body and it will guide the agencies that would like to use the tools of carrying capacity based developmental planning. This tool is useful for the optimization of shrimp aquaculture development by framing future guidelines and policies for environmentally compatible and sustainable development of shrimp farming and helps State governments and other regulatory organizations to regulate the level of shrimp farming activity for each receiving water body.

Assessment of suitable sites for increasing brackishwater aquaculture using MCDSS

GIS based multi-criteria decision support system was developed by CIBA to tap the unutilized brackishwater resources for the development of sustainable aquaculture. Potential sites for aquaculture have been identified after incorporating CAA guidelines of land use, buffer zone, distance from water resource, and drainage pattern and soil texture through multi criteria spatial analysis. The methodology was evaluated for the selected coastal districts in Tamil Nadu and Andhra Pradesh. This will pave the way for the identification of suitable untapped resources in the coastal States of the country for sustainable brackishwater aquaculture.

Aquaculture development not at the cost of mangroves in India – CIBA study

Conversion of mangroves is one of the major issues raised over the development of aquaculture worldwide. Major mangroves such as Pichavaram, Muthupet, Sunderbans, Coringa, Krishna, the Gulf of Khambat and Mahanadi in the coastal states of India were studied comparing the pre aquaculture period and the present status using multi-temporal satellite





data and GIS spatial analysis. The study found that mangrove areas have increased in all the coastal States except Andhra Pradesh. The changes in mangroves were influenced by natural processes such as erosion and accretion. Unlike other shrimp growing countries in Asia, mangrove lands were not used for shrimp farming in India as revealed by ICAR - CIBA study.

Ammonia and nitrite oxidizing and denitrifying bacteria in brackishwater shrimp culture ponds

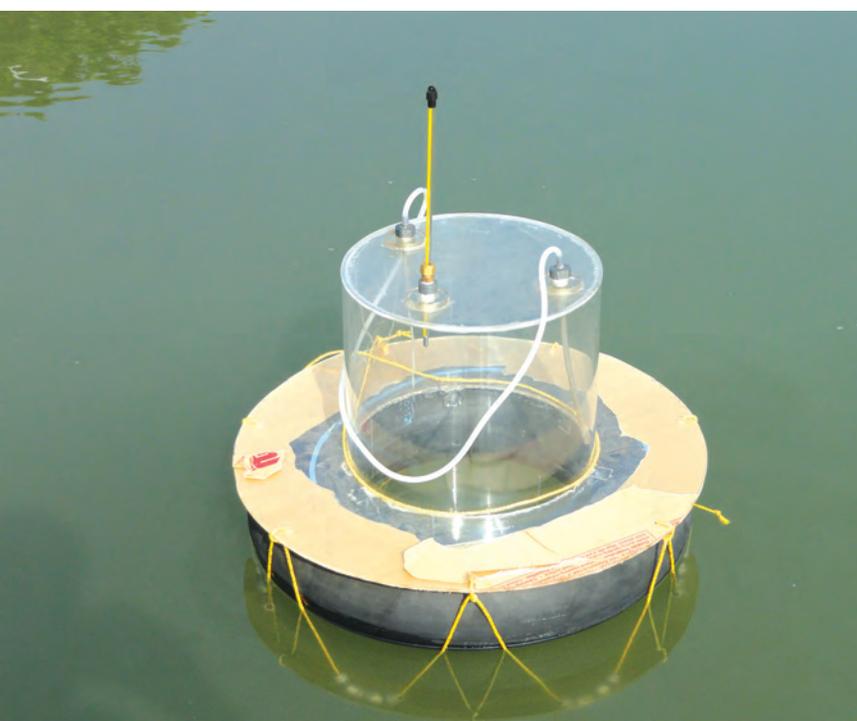
Two new methods viz., a differential filtration-micro irrigation method for rapid enrichment of chemolithotrophic ammonia and nitrite oxidizing bacteria (AOB and NOB) and a simple method for qualitative confirmation of denitrifying bacteria were developed and evaluated. Methods developed for large-scale production of AOB-NOBs.

Quantification of greenhouse gases from aquaculture ponds

Methodology was developed for quantifying the greenhouse gases emissions from aquaculture ponds. A floating

chamber was fabricated for the collection of greenhouse gases from aquaculture ponds and standardized the methodology for the simultaneous estimation of GHGs.

- Farmers perceptions on the impact of climate change on aquaculture, and mitigations and adaptation measures for climate resilient brackishwater aquaculture were documented. The vulnerability of coastal farmers to climate change was assessed in one district each in all the coastal States of India using vulnerability indexes and GIS mapping.
- Assessment of the impact of extreme climatic events (Aila Laila, Thane, and Phailin cyclones) on aquaculture indicated infrastructure damage and stock loss in shrimp aquaculture.



A floating chamber for green house gas collection



Portable water analysis kits

- pH and DO water analysis kit technology was transferred to M/s Fisherman's, Itarsi, Madhya Pradesh.
- Ammonia and nitrite analysis technology was transferred to Shrimpex, Chennai.
- MoU was signed with Mr. Maghimai Marcus, Chennai in 2015 for Consultancy services to set up Aqua Diagnostic Laboratory.

Social Science and Development

Brackishwater aquaculture based livelihood for coastal Women Self Help Groups (WSHG)

The economic viability and sustainability of brackishwater aquaculture-based livelihood options for women self-help groups, viz., Crab farming ornamental fish culture, nursery rearing of fin fishes and farming of seaweeds were assessed and found that they were viable and could be sustainable through sourcing of quality inputs, capacity strengthening and scale up-gradation.

Integrated multi-trophic farming for natural resource management and livelihood security

Land shaping is altering the land surface primarily to harvest rainwater for irrigation, reducing the effect of ground water salinity, drainage congestion and grow multiple and diversified crops at different trophic levels round the year. Excavation of 3-5 cents of low land up to a depth of 9 ft, 5ft wide and 4ft height, using that soil to raise the adjoining land up to 1.5 ft and land embankment around the area by 3ft wide and 3 ft height can harvest 6-9 acre inch of rain water during the monsoon. The stored water could be utilized for culturing fish, cultivating a second crop and raising vegetables, fruit trees on the bunds without altering the ground water level. This family farming technology can provides round the year employment to the coastal households, more income and livelihood security. About 36 ha was converted as land shaping units was for rain water harvesting and multi-trophic farming in West Bengal. Inputs were distributed to the farmers' families for round the year cultivation of crops and fish. This technology intervention significantly contributed for conservation of water for productive purposes,



effective utilization of land space, employment generation for the family / others, improved production from the land / pond, self-sufficiency in food production, adequacy of income from farming and prevention of migration of farm families to towns and cities in search of livelihood.

Data Base on Indigenous Technical Knowledge (ITK) system in aquaculture

A data base to document the traditional knowledge (ITK) in aquaculture was developed. The system was designed using various identified attributes such as the title of ITK, rationale, location, impact on user, broad use, adverse effect, materials used, target species, convenience, timeline and technical feasibility. In this system, search module is used to search and retrieve information based on users' key-words category-wise, location-wise, usage-wise and / or timeline-wise.



FAQs on Pacific white shrimp (*Penaeus vannamei*) farming



Extensive field investigations and interactions with farmers revealed that farmers, field-level extension workers and other stake holders are to be sensitized about the risk factors in vannamei shrimp farming and to sustain the present level of production. In this connection, as part of our capacity development intervention, we have brought out a handbook on 'Frequently Asked Questions (FAQs) Pertaining to *Penaeus vannamei* Shrimp Farming', which contains all possible queries along with explanations regarding vannamei shrimp farming. Subsequently risk communication to sensitize the farmers and extension workers regarding the risk factors and management measures were undertaken in the form of training workshops in the States of Tamil Nadu (Nagapattinam), Odisha (Cuttack), Andhra Pradesh (Ongole), Maharashtra (Palgarh), Goa (Ela) and Karnataka (Kumta and Kundapura).

Technology dissemination through information kiosk and mobile phones

A farmer-friendly touch screen built information kiosk on BMPs of shrimp farming was developed and installed at Avarikkadu village of Nagapattinam district in Tamil Nadu. The information kiosk enables the farmers to access scientific practices on BMPs in simple language covering site selection, bio-security, seed selection, stocking, soil and water management, feeds and feed management, health management and harvest. Similarly, application of mobile telephony for information diffusion was initiated with dissemination of 68 messages via SMS for the fishery extension officers of the Department of Fisheries of Tamil Nadu, Andhra Pradesh, Odisha, West Bengal and Gujarat about *P. vannamei* farming. Further, phone-in-programmes were conducted on better management practices in shrimp culture, seabass farming and farm management practices of *P. vannamei* for the benefit of small scale shrimp farmers in vernacular language.



Know your species

Penaeus vannamei

Penaeus vannamei, commonly known as the Pacific white leg shrimp, is the largest farmed species of crustacean globally in terms of production. The species accounts for 79.6 % of the global farmed shrimp production in, 2015-16. *P. vannamei* is native to the Pacific coast of Mexico, Central and South America as far south as Peru, in areas where water temperatures are normally >20°C throughout the year. *P. vannamei* has become the primary cultured species in Latin America, from the USA to Brazil, over the past 20-25 years. In 1989, US Marine Shrimp Farming Program (USMSFP) developed the first population of specific pathogen free (SPF) *P. vannamei*, and it was successfully introduced in more than 44 countries for commercial aquaculture, including many South East Asian countries.

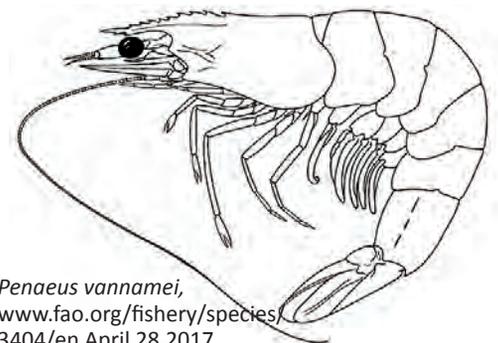
Although there were instances of *P. vannamei* introduction into Asia experimentally from 1978-1979, it was introduced for commercial culture only since 1996 into China and Taiwan, followed by most of the other coastal Asian countries in 2000-01. Perceiving the performance of selectively bred SPF vannamei, Indian farmers also wanted to import SPF vannamei. Subsequently, in 2009, GOI (DAHDF) decided to import selectively bred, SPF vannamei from the western world. The Govt. of India granted permission to two private firms (Sharat Sea Foods Industries and BMR Exports) in 2003, for importing specific pathogen free (SPF) broodstock of *P. vannamei* from Hawaii for pilot scale experimentation. The Ministry of Agriculture, Govt. of India, constituted a committee



UNIQUE FEATURES

- Open thelycum species - enabling ease in domestication, genetic selection and closing of life cycle.
- High larval survival. Amenable for farming under high stocking densities (50-300 pieces/m²)
- Wide salinity tolerance.
- Hardy for extreme water parameters
- High survival and fast growth rate of up to 3g/week with an average of 1 to 1.5 g/week
- Low dietary protein requirement at 32 to 35 % crude protein
- Colum feeding and acceptance of biofloc as natural feed

including ICAR-CIBA, Chennai, and ICAR-NBFGR, Lucknow, to conduct an Import Risk Analysis for the large-scale importation of white-legged shrimp, *P. vannamei* into India. ICAR-CIBA as the nodal agency in the brackishwater sector, played a critical role and carried out the study which involved the review of pilot-scale importation and culture of *P. vannamei* by the two licensed firms, the status of the bio-security in Indian shrimp farms through rapid survey in the progressive States of Andhra Pradesh and Tamil Nadu, Import Risk Analysis, and formulation of regulatory framework for the low-risk scenarios. Considering the experiences in pilot scale introduction, in 2008, the Govt. of India permitted the import of *P. vannamei*.



Penaeus vannamei,
www.fao.org/fishery/species/3404/en April 28, 2017



EVENTS »



Workshop on cost effective shrimp farming through CIBA aquafeed and BMP adoption

A workshop on “Cost Effective Shrimp Farming through CIBA Aquafeed and BMP adoption” was organised by the Institute on 23.02.2011 at Ramanathapuram. In the Technical Session of the workshop, various aspects of the

Better Management Practices in shrimp farming, mainly involving feed, health and soil and water quality management, were discussed in detail among the CIBA scientists and the participants. The shrimp farmers

who are associated with the demonstration trial of the shrimp culture using CIBA feed shared their experience and the success stories with the participants.

Result Dissemination Workshop of CIBA-NACA Collaborative Aquaculture Project

The Central Institute of Brackishwater Aquaculture (CIBA), the Indian partner of an International Project on Strengthening Adaptive Capacities to the Impacts of Climate Change in Resource-poor Small- scale Aquaculture and Aquatic Resources-

dependent Sector in the South and South-east Asian Region (Aquaculture) organized a *Results Dissemination Workshop* on 18th July 2012 at CIBA, Chennai for the dissemination of project results and technical and policy briefs were developed to prepare the shrimp aquaculture as climate resilient. The major recommendations of the workshop are the fine-tuning of farmer's technical, science & technology and policy recommendations.



Workshops on Climate Change and Coastal Aquaculture: Impacts, Adaptations and Mitigations for Resilience

Stakeholders and focus group Workshops on Climate Change and Coastal Aquaculture: Impacts, Adaptations and Mitigations for Resilience were organized by CIBA, Chennai under the project National Initiatives on Climate Resilient Agriculture (NICRA) on 24th October, 2011 at Bhimavaram (Andhra Pradesh), on 9th March 2015 at Palghar (Maharashtra), on 11th March 2015 at Goa, on 12th and 13th March at Kumta and Kundapur, respectively (Karnataka). All the stakeholders

pertaining to brackishwater aquaculture attended these meetings. Important and notable climate change events being experienced by the farmers at their

respective places and impacts on aquaculture along with the adaptation measures were discussed during the workshops.



Workshop on Asian seabass farming in pond culture system

A concluding Workshop of the NFDB project on Demonstration of Asian Seabass farming was organized at the CIBA Headquarters on 23rd February 2013. More than 250 stakeholders including farmers from West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and many entrepreneurs, experts and academicians attended the Workshop. Dr. S. Ayyappan, Secretary, DARE & DG, ICAR inaugurated the workshop and addressed the gathering. In his inaugural address, he appreciated the achievements made in Asian seabass farming through this NFDB project using artificial feed.

Brochures on seabass farming in 9 different regional languages were released. Dr R. Prabakaran, Vice Chancellor of the Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Dr. M. Sakthivel, President of the Aquaculture Foundation of India, Dr. R. A. Selvakumar, former ADG (M. Fy), ICAR, Dr Paul Pandian, the Executive Director (Technical), NFDB, Dr. A. G. Ponniah, Director, CIBA and Dr. A. R. Thirunavukkarasu, Head, Finfish Culture Division and Principal Investigator of the project graced the occasion.

Capacity Building Programme on 'Climate Resilient Aquaculture'

Farmer's awareness Capacity building programme on 'Climate Resilient Aquaculture' was organized at Srikakulam, Andhra Pradesh on 4th March, 2015 under NICRA project. The programme was inaugurated by District Collector and felicitation addresses were given by Deputy Director of Fisheries, Srikakulam District and CEO, National Centre for Sustainable Aquaculture. NICRA project studies related to the perception of climate change events and their impacts on aquaculture was explained to the farmers. The information on major climate change events being experienced in the district over the last 10 years was obtained. Adaptation measures and better

management practices for climate resilient aquaculture was obtained.



Dr. P. Lakshmi Narasimham, Collector, Srikakulam District addressing the gathering





Study visit of the Parliamentary Standing Committee on Agriculture

The Institute organized a study visit of the Parliamentary Standing Committee on Agriculture, comprising thirteen Honorable Members of Parliament, five Officers from the Lok Sabha Secretariat, two Officers from the Ministry of Agriculture and three Officers from ICAR, New Delhi, in Chennai during Jan 30th to Feb 2nd, 2015. The Chairman of the committee was Shri Hukumdev Narayan Yadav, Honorable Member of Parliament. The committee visited the various research facilities of CIBA at its Muttukkadu Experimental Station (MES) and had a detailed insight into various research activities of the Institute. About 60,000 seabass seeds were distributed to aqua-farmers of Andhra Pradesh, Gujarat, Tamil Nadu and Odisha during their visit. After the tour to the

various research facilities of MES, an informal meeting was conducted. Dr. K.K. Vijayan, Director, CIBA gave a brief presentation of CIBA's research initiatives to cater to the needs of the brackishwater aquaculture sector in the country. The delegates appreciated the practical and field oriented research undertaken by CIBA. The Honorable Chairman of the Committee, Shri Hukumdev Narayan Yadav in his concluding remarks, exhorted that CIBA should continue the excellent research work in the areas of brackishwater aquaculture and appreciated and congratulated the scientists of CIBA under the leadership of Director, Dr. K. K. Vijayan.



Hon'ble MPs at CCD hatchery, CIBA MES during the visit of Parliamentary Standing Committee on Agriculture

➤ Brainstorming session on creating and sustaining interest in agriculture among the youth

As an initiative of the National Agricultural Research System (NARS) and The Hindu, a brainstorming meeting was conducted on 25th October 2014 at CIBA, Chennai, to attract the youth and sustain their interest in agriculture. This meeting was held in the presence of Dr. S. Ayyappan, DG, ICAR, Dr. Sreenath Dikshit, ICAR-Zonal Project Directorate, Bangalore, Dr. K.K. Vijayan, Director, CIBA, Mr. Rajiv C. Lochan, Managing Director, Mr. V. Jayant, Senior Managing Editor, and Mr. M.J. Prabhu, Agricultural Correspondent, The Hindu publications. Participants in this

brainstorming event were Vice-Chancellors, Directors of Extension, Programme Directors, farmers, agricultural entrepreneurs, scientific colleagues and students. Dr. S. Ayyappan, DG, ICAR, stressed that monsoon, market, mind-set and media play a major role in agriculture development. He mentioned that by 2050, 50% of rural population, 52% of work force, would be engaged in agriculture and that 50% youth should be brought into the agriculture sector. Dr. Sreenath Dikshit, ICAR-Zonal Project Directorate, Bangalore, explained that the purpose of the brainstorming session was to evolve a basic plan for

a mission mode project on a pilot basis for one to two years in the States of Tamil Nadu, Karnataka and Kerala, particularly to attract the rural youth towards agriculture and to impart fundamental knowledge in agriculture including its allied enterprises among school children, in coordination with Krishi Vigyan Kendras.



Launching of ARYA programme by Hon'ble Director General, ICAR, Dr. S. Ayyappan at CIBA with the association of *The Hindu*

Training workshops on “Production Risks and Better Management Practices of Pacific White Shrimp (*Penaeus vannamei*) Farming”

Training workshops were conducted in coastal states, Odisha (29th September 2014), Andhra Pradesh (10th October 2014), Maharashtra (9th March, 2015), Goa (11th March, 2015) and Karnataka (12-13 March, 2015) to sensitise shrimp farmers/ professionals, fishery officials and other stakeholders. A booklet on Frequently Asked Questions (FAQs) pertaining to *Penaeus vannamei* shrimp farming along with answers for the benefit of field level extension workers and farmers was released.



Training workshop on *P. vannamei* at Ongole, Andhra Pradesh

➤ National Seminar in Hindi on Traditional Aqua farming System: Prospects and Challenges

Kakdwip Research Centre of CIBA organized the National Seminar in Hindi during 11th & 12th December, 2012. The major thrust behind this was to give further impetus to Rajbhasha and disseminate information to the stakeholders across the country. The Chief Guest Dr A P Sharma, Director, CIFRI, Barrackpore while inaugurating the National Seminar appreciated the efforts of CIBA for conducting the National Seminar in Hindi at Kakdwip and explained the role of traditional aqua farming, and how it has helped the livelihood of coastal farming communities in West Bengal, Kerala and other States. Dr P Das, former Director, NBFGR, Lucknow, Dr A G Ponniah, Director, CIBA and Chairman graced the inaugural function.



Technical session during Hindi Seminar at Kakdwip Research Centre of CIBA

Farmers Meet

Kakdwip Research Centre of CIBA organised Brackishwater Farmers Meet on 9th December 2014 with great enthusiasm. Dr. P. Ravichandran, Member Secretary, Coastal Aquaculture Authority of India, Chennai inaugurated brackishwater farmers meet. Dr.

(Mrs) S. Bhattacharya, Joint Secretary, Department of Fisheries, West Bengal and Dr. K.K. Vijayan, Director, CIBA graced the occasion.



Dr. K.K. Vijayan, Director, CIBA distributing low cost polyculture feed during farmers meet at Kakdwip on 9th December 2014



CIBA IN NEWS MEDIA

CIBA tests nursery-reared crabs in mangrove forest

T. Appala Naidu

SORLAGONDI (KRISHNA): A year after experiment on crab fattening technology in cultivation of mangrove crab (Sylla serrata), the Chennai-based Central Institute of Brackishwater Aquaculture (CIBA) is now testing nursery-reared crabs in the Sorlagondi mangrove forest in Krishna district.

Scientists of the CIBA have released above 500 crabs of different sizes into a pond here on August 25 and harvesting of same sizes was expected by the end of the year. The Yanadi tribals, who are engaged in hunting of Sylla serrata in the mangrove forest and trained in crab fattening technology through floating cages, were involved in the experiment.

"We have developed a three-stage crab cultivation system, each span for 2-3 months. The farmers will be able to sell their produce at the end of any of these phases," said CIBA Director K. K. Vijayan.

Sylla serrata culture expert C.P. Balasubramanian opines that the three-stage system will further optimise the survival of the crab which is a serious issue in the mud crab cultivation.

The CIBA will also study various parameters of the growth of the crab and water and weather conditions to ascertain the survival rate of the nursery-reared crabs in the mangrove forest.

The Yanadi tribal families would collect the crabs from the common pond after the crabs attain a sufficient size in order to shift them to



A Yanadi couple displaying mangrove crab (Sylla serrata) at Sorlagondi mangrove forest in Nagayalanka mandal in Krishna district.

PHOTO: T. APPALA NAIDU

Scientists of the CIBA have released 500 crabs into a pond on August 25 and harvesting is expected by end of the year

neighbouring ponds. Since the experiment was a part of the Scheduled Tribe's Sub-Plan, the Yanadi tribals would also be allowed to sale the harvest.

Feed and market

CIBA's Nutrition expert

Syama Dayal told *The Hind* that the feed for the mud crab has already been formulated and being tested during the experimental stage at the mangrove forest.

Since Sylla serrata fetches up to a maximum of Rs 1,200 a kg in the domestic market, many progressive farmers have also shifted

from prawn cultivation to crab cultivation.

It is also learnt that the crab will attract a good number of farmers, provided they get easy access to crab seeds. The CIBA would strive to promote crab cultivation in the State in the coming years.

telugu daily : Andhra gyothi
Date: 20/7/14



పీతల పెంపకానికి సిబా చేయూత

పొగాకులకు మొదలైన పంటలకు పీతల పెంపకం అనేది ముఖ్యమైనది. పీతల పెంపకం అనేది పంటలకు ముఖ్యమైనది. పీతల పెంపకం అనేది పంటలకు ముఖ్యమైనది. పీతల పెంపకం అనేది పంటలకు ముఖ్యమైనది.



పీతల పెంపకం కోసం సిబా చేయూత. పీతల పెంపకం కోసం సిబా చేయూత. పీతల పెంపకం కోసం సిబా చేయూత.

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Shrimp has lower cholesterol than egg: Study

Utejonmayam@timesgroup.com

Chennai: Medical practitioners and dieticians have for long recommended adults to stay away from eating shrimps as it is considered high in cholesterol. Now, a study shows, to the non-vegetarians' delight, that the traditional wisdom may be flawed.

A study by Central Institute of Brackishwater Aquaculture recommends that healthy individuals should have a moderate quantity of shrimps as part of their daily diet as the cholesterol in it is not as bad as it was presumed. In fact, the study says, shrimps have low saturated fatty acids, moderate levels of cholesterol and low lipid levels and high levels of protein

KNOW WHAT YOU EAT

Food	*Saturated fatty acids		
	SFA* (g/100g)	Cholesterol (mg/100g)	Atherogenic index
Shrimp	0.25	173	0.36
Egg	0.25	400	0.40
Chicken	6.0	100	0.50
Mutton	7.0	65	1.00
Beef	8.0	70	0.70
Pork	13.0	90	0.67

Besides containing macro and micro minerals including calcium, phosphorus and selenium, shrimps are also found to be a rich source of polyunsaturated fatty acids (PUFA) required for a healthy diet. Head of cardiology department, Government Medical College Hospital, Dr Kannan

healthy individuals can have a small quantity of shrimps. "As for heart patients, we would still recommend small fish as they are rich in omega-3 fatty acids," the doctor said. Scientists analysed the nutritional composition of 100g of tiger shrimps and white

which increases blood cholesterol was found to be low in shrimps (0.25mg/100g) compared to other meat like chicken, mutton, beef, pork and even egg. The level of dietary cholesterol in shrimps (173mg/100g) is lower than in of egg which is 400mg/100g. The American Heart Association (AHA) recommends less than 300mg/day of dietary cholesterol for healthy individuals and less than 200mg/day for diabetics. 100g of shrimps provide less than the recommended cholesterol. The lipid (fat) levels in shrimp were found to be around 1.15g/100g, which is the lowest compared to other meaty food. Senior scientist J Syama Dayal said that about 32%

rated fatty acids (PUFA), a healthy fat that can improve blood cholesterol levels as well as decrease the risk of heart disease and type 2 diabetes. While a healthy diet should have a PUFA/SFA ratio of at least 0.54 and above, shrimps provide more than 1.9. Shrimps also provide vitamins A, D, E, B12 and B3. It also has astaxanthin, a potent natural antioxidant. With 80% of its dry matter having protein, shrimps can provide 87% of the total energy needed for the body. While the study recommends moderate quantity of shrimp for healthy individual to benefit from its vital nutrients, it suggests that those with clear risk of CVD and diabetes may, however, avoid





Human Resource Development

- During the last 5 years 16 Scientists got international training and scientists of the Institute attended 29 International Workshops/Conferences/Consultations.
- Sixty scientists were deputed for different training programmes within the country.
- 20 students of the Institute were awarded Ph.D by Madras University.

Technologies developed and commercialised

ICAR-CIBA has developed many farming technologies which are transferred free to farmers and fisheries and other development departments. CIBA also has developed the following technologies which are available for commercialization.

- CIBA organic shrimp feed, CIBA Bhetkiahar
- CIBA shrimp feed technology
- Matrix technology for immobilization of bacteria
- Asian seabass seed production technology
- DNA based white spot diagnostic kit
- Molecular kit for the detection of chemolitho autotrophic bacteria
- Molecular kit for the detection of ammonia oxidizing and ammonia-removing bacteria/bacterial products
- CIBASTIM – Immunostimulant for shrimps
- CIBA Immunodot technology for detection of WSSV
- Quantification of disused shrimp farms using remote sensing
- GIS based multi-criteria decision support system for the identification of suitable potential sites for brackishwater aquaculture
- Biostimulator for ammonia detoxification
- Greenwater technology for coastal aquaculture
- Kit for the analysis of ammonia, nitrite and phosphate in brackishwater
- Biosorbent for the removal of heavy metals
- Substrate for imaging bacteria through scanning electron microscope
- NOVA RT- PCR kit for the diagnosis of Laem-Singh Virus (LSNV),
- CIBA CMH kit for testing Ca, Mg and hardness in pond waters

A total of nine MoUs were signed with clients transferring/ licensing or for collaborative research programmes on seven CIBA technologies with revenue generation of Rs. 14.60 lakhs.

- Transfer of shrimp feed processing and production with M/s. M.K. Feeds (Pvt.) Ltd., Kolkatta.
- Evaluating Isphagula by-products as binders for shrimp feed with M/s. Hydrochem Products, Kolkata
- Consultancy service for shrimp hatchery establishment with M/s. Neer Aquaculture Exports (Pvt.) Ltd, Gujarat.
- Consultancy services for development of probiotics and disinfectants with M/s. Rajshree Biosolutions, Theni district, Tamil Nadu
- Shrimp larval feed demonstration and technology transfer with M/s. Maritech, Chennai.

Patents and Copyrights

a. Patents granted

S.No.	Title of the Invention	Inventors	Status
1	Product from lignocellulosic waste for the remediation of water contaminated with heavy metals	Dr. K.K. Krishnani, Dr. B.P. Gupta and Dr. P. Ravichandran	Granted on 14.06.2013, No. 256424
2	Immobilizing matrix from bagasse for bacterial biomass and a process for preparation thereof	Dr. K.K. Krishnani, Dr. I.S.Azad, Dr. B.P.Gupta, Dr. M. Shashi Shekhar and Dr. P. Ravichandran	Granted on 03.07.2013, No. 256572

b. Copyrights granted

S.No.	Title of the Invention	Inventors	Status
1	Software for the estimation of carrying capacity of water body for shrimp farming version 1.0	Dr. M. Muralidhar	Granted, No. SW-4460/2010 on 07/04/2010

Publications

In peer reviewed Journals	: 218
Popular articles	: 73
Book Chapters	: 33
Proceedings	: 374

CIBA's in-house publications

Research Bulletin

1. Diseases of mud crabs in India No.20
2. Status of mangroves in relation to brackishwater aquaculture development in Tamil Nadu, India.

Technology Series

1. Low Input Low Cost Shrimp Farming System Based on Organic Principles.

Special publications

1. Training manual on Brackishwater Aquaculture
2. Asian seabass fish seed production and culture
3. Advanced technologies for the management of soil and water environment in brackishwater aquaculture
4. Training manual on better management practices in shrimp farming
5. Training manual on Mud crab breeding and culture
6. Handbook on seed production and farming of *P. vannamei*
7. Handbook on biosecurity measures for shrimp farming
8. Socio-economic and gender analysis in aquaculture





9. Recent trends in brackishwater aquaculture - Manuel for officers of fisheries discipline, NABARD.
10. Application of HACCP principles in shrimp hatchery for disease risk mitigation.
11. Best practices in shrimp farming.
12. Training manual on Recent Trends in finfish and crustacean grow-out practices.
13. Proceedings of the Hindi Workshop : Recent Advance in aquaculture (both CD & Print) [Hindi].
14. Advances in Aquaculture nutrition and feed processing technology.
15. Empowerment of women stakeholders (ST & poor on aquaculture and allied technologies).
16. CAA regulatory guidelines and BMPs for sustainable aquaculture.
17. Nutrient use efficiency in aquaculture.
18. Aquaculture database system for culture practices (ADS) Ver 1.0 (Catalogue).
19. Sustainable shrimp farming through adoption of BMP and biosecurity.
20. Manual on Seed production and larval rearing of Asian seabass, *Lates calcarifer*.
21. Management of emerging diseases of shrimp with special reference to Pacific white shrimp *Penaeus vannamei*.
22. Capacity building of tribal women Self Help Groups on brackishwater aquaculture and allied Agro-based technologies.
23. Farming of banana shrimp and brackishwater finfishes in Gujarat State.
24. Vannamei eral valarpu melanmai (Tamil).

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1. Banana shrimp
2. An appraisal of Better Management Practices in Penaeid shrimp hatcheries.
3. Fact sheet on Ethoxyquin Residues.
4. No Confirmed Cases of Early Mortality Syndrome (EMS) in India.
5. Successful women entrepreneurs in aquaculture sector in Tamil Nadu.
6. Methodology to trace the nitrogen pathway in shrimp culture.
7. Concept of using nano sensors for water quality monitoring in aquaculture.
8. Banana shrimp: A potential diversified species for culture in low temperature coastal areas (in Hindi) (CD) (English e Publication Series No.16).
9. Technical advisory on steps for first time confirmation of an exotic disease – A case study with EMS/AHPND.
10. Ensuring WSSV free sediment and water for prevention of white spot disease.
11. Redox potential as an indicator of pond bottom sediment condition.

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