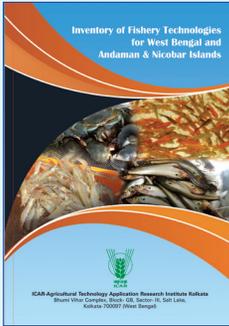


# INVENTORY OF FISHERY TECHNOLOGIES FOR WEST BENGAL AND ANDAMAN & NICOBAR ISLANDS



भारतीय  
ICAR

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Bhumi Vihar Complex, Block- GB,  
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### **Printed by:**

Eastern Printing Processor, Kolkata-48



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## MESSAGE

I am very happy to learn that ICAR-Agricultural Technology Application Research Institute, Kolkata (ICAR-ATARI, Kolkata) is going to publish a compiled document on "Fishery Technology Inventory for West Bengal and Andaman & Nicobar Islands" under the guidance of Agricultural Extension Division, ICAR, New Delhi. The document covers various aspects of different aquaculture and fisheries technologies developed in recent years by the Fisheries Research Institutes of this country, which is expected to provide all need-based information on the relevant subject area to the fish farmers/ fishermen. I strongly believe that the information would not only help in appropriate adoption of the relevant technologies by our farmers in scientific lines, but also lead to effective resources utilization and assuring higher income.

I congratulate the efforts of the Director, ICAR-ATARI, Kolkata and his team for taking initiative to prepare such a valuable document, at a time when the whole country is gearing up for boosting the income of the farmers.

I wish the contributors all success in their future endeavours.

(J.K. Jena)





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## MESSAGE

I am pleased to see that ICAR-Agricultural Technology Application Research Institute Kolkata has come out with a publication in the form of Repository of Technologies in Fishery Sciences for West Bengal and Andaman & Nicobar Islands. The technologies can immensely contribute in uplifting socio-economic status of fish farmers in the region through creating additional income from the existing resources. Keeping in view the past performance of Krishi Vigyan Kendras (KVKs) in these states, KVKs can impart training to the farmers for creating awareness and demonstrate these technologies at farmers' field for large scale adoption.

I appreciate ICAR-ATARI Kolkata Team and Scientists for their efforts in bringing out a useful publication for fish farming community. I am confident that Scientists and farmers together can bring a desirable change in the fishing sector and make it more profitable.

(Ashok Kumar Singh)





डॉ. सती शंकर सिंह, निदेशक  
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## FOREWORD

ICAR-Agricultural Technology Application Research Institute (ICAR-ATARI) is a gateway of transferring and implementing recent technologies emerging from various Research Institutes and State Agricultural Universities to the farmers' field through Krishi Vigyan Kendras located at every district of our country. The scientists, engaged in Indian Council of Agricultural Research (ICAR) system, are very much concerned about their clients, i.e. farmers for delivering vibrant technologies which can substantially increase farmers' income through enhancing various farm produces. Like other sectors, fishery sector plays pivotal role in farmers' including national economy. The report of National Fisheries Development Board (NFDB) depicted that India produced about 6.3% of the global fish production, and the fishery sector contributed 1.1% of the GDP and 5.15% of the agricultural GDP. Out of total fish production (10.07 million metric tonnes), inland fishery had nearly 65% contribution. At present, fish and fish products, with 10.51 lakh tonnes in terms of quantity and Rs.33442 crores in value, have emerged as the largest group (20%) of total agricultural exports of India. The produces are being exported to 75 countries around the world. Considering the potentiality of fishery sector of West Bengal and Andaman & Nicobar Islands, there is urgent need to prepare a technology repository which can help in formulating large scale developmental projects to promote fishery. Accordingly, the work was assigned to a team of scientists from ICAR-ATARI, Kolkata and other surrounding Institutes for developing a document as "*Inventory of Fishery Technologies for West Bengal and Andaman & Nicobar Islands*".

I really appreciate the endeavours of the whole team engaged in bringing out this publication which covers various technological aspects of fishery sciences viz. fish breeding, fish culture, post-harvest technology and value addition etc. I am confident that this document will be a very good source of recent technologies for fish farmers, researchers, scientists and planners. With these technologies, the fishery sector of West Bengal and Andaman & Nicobar Islands can achieve a new height of prosperity and can boost National economy.

Director



---

## PREFACE

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Fishery sector of West Bengal state and Andaman & Nicobar Islands is one of the potential sources of nutritious food, income and employment generation for economically backward people and agricultural exports. The West Bengal state is bestowed with more than 20 million impounded water bodies and ample open water resources in the form of rivers, canals, streams and tributaries. The state produced 20% (16.71 lakh metric tonne) of total fish production in the country, and exported 11.33% (\$ 530.91 million) of total marine fish products from India during 2016. The production could have been more, if the available water bodies were efficiently utilized for pisciculture. However, with the passage of time, more and more people are getting themselves involved in fisheries as fish constitutes the staple food for majority of the people in the region. On the other hand, Andaman & Nicobar Islands have substantial area of coastal length measuring about 1912 sq km and continental shelf area of about 35000 sq km. The Exclusive Economic Zone (EEZ) around these Islands is about 6 lakh sq km forming 28% of the total EEZ area of the country. From inland water sources, the annual fresh water fish production is limited to 90 tonnes. The potential yield of Islands fishery is around 1.48 lakh tonnes. Andaman and Nicobar Islands produced 35264 tonnes fish from Marine and Inland sources, and exported 1684.47 tonnes of fishes/ fish products including tuna, prawn, lobster, crabs, shrimps, shark etc. More than 100 societies/ NGOs are involved in different fishery activities in the Islands.

Considering the present scenario of global warming and biodiversity depletion, water body pollution, huge demand and supply imbalance for continuous growing population, sustainability of livelihood income of fish farmers including fishermen, availability of recent scientific technologies for stimulating fish production and fish marketing strategies, the fishery sector is passing through the big challenges for its future prosperity/ existence. Most of the above issues need administrative interventions from high level authorities at State / National level for their settlement through systematic planning and implementation. At this juncture, it is very essential to bridge the knowledge gap through providing recent technologies to the fish farmers/ fishermen which can enhance fish productivity as a whole under existing conditions. As per the recommendations in the Meeting of ICAR Regional Committee No. II and with the active involvement of scientists of ICAR-Agricultural Technology Application Research Institute Kolkata, an effort has been made to develop an inventory relating to Fishery Science Technologies in the name of “*Inventory of Fishery Technologies for West Bengal and Andaman & Nicobar Islands*” which contains recent fishery technologies available with various Fishery institutes for enhancing fish production in various kinds of water bodies in the region. This compilation is a source of various technologies related to Fishery Sciences and will definitely help fish farmers in using various technologies, scientists and planners in developing region specific strategies to increase fish productivity.

We thank all the contributors of this manuscript especially Scientists, Director of Fishery Institutes/ Vice Chancellor of State Agricultural Universities for generous sharing of fishery technologies developed at their Institutes. Our sincere thanks and gratitude are also due to the Director, ICAR-Agricultural Technology Application Research Institute Kolkata for giving the opportunity to work for the society who are mainly dependent on fish farming in the region. We extend our heartfelt thanks to all who directly or indirectly helped us to prepare this document.

- Editors



If I have seen further it is by standing on the  
shoulders of Giants.

- Isaac Newton

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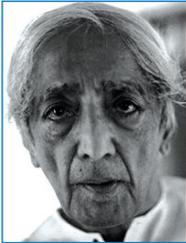
True knowledge is not attained by thinking. It is what you are; it is what you become.

- Swami Vivekananda

# CHAPTER 1

---

## Brackish Water Aqua Culture



You must understand the whole of life, not just a little part of it.

- Jiddu Krishnamurti

# INDIGENOUS SHRIMP FEED TECHNOLOGY

Feed, being a critical input in shrimp farming, not only determines the growth performance of the shrimp, but also a key factor related to the cost of shrimp production and its sustainability. In the beginning, the Indian shrimp farming sector was completely dependent on imported feeds. No single public or private entity was having the technology to manufacture pelleted sinking feed for shrimp. Visualizing this as a critical obstacle, ICAR-CIBA developed a tested and commercialized indigenous feed manufacturing technology as pioneer in India.

## Scope

Cost effective formulated pelleted feed using indigenous feed technology will support Indian shrimp farming to a greater extent.

## Cost

Eighty lakhs to three crores for machineries based on the level of production and automation plus working capital required @Rs. 40, 000/- per ton of feed.

## Benefits

- Technology package involves establishing the feed mill, formulation, periodical auditing of the formula, the process of feed manufacturing and evaluation of the processed feed.
- Indigenous machinery.
- Uses low cost locally available ingredients.
- Cost effective customizable formulation.
- Preparation of feed in different particle sizes for different stages of shrimps.



## Source

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## SHRIMP LARVAL FEED: SHRIMP LARVI <sup>PLUS</sup>

Functional feeds are formulated to have different biologically active compounds that can provide specific benefits to the farmed fish/ shrimp, besides nutritional benefit. There is an increasing trend in gaining knowledge for using functional feeds in commercial aquaculture. Stakeholders are looking for feeds with functional properties related to high digestibility of feed, survivability and rapid maturation of larva, maintaining sound gut health etc.

### Scope

Larval feeds are currently imported and costing Rs. 1500/- to Rs. 3000/- kg. ICAR-CIBA has developed cost effective indigenous larval feed of superior quality. These feeds are import substitutes, saving valuable foreign exchange for the country.

### Cost

Rupees two to three crores based on production capacity plus working capital required @ Rs. 1, 40,000/- per ton of feed.

### Benefits

- Contains 55% crude proteins and 12% lipid.
- Ingredients with high digestibility.
- Enriches with optimal EPA and DHA.
- Micro-particulate size of 200-300, 300-400 and 400-500  $\mu\text{m}$ .
- Spheronizes feed of 300 and 500  $\mu\text{m}$ .
- Tested in commercial vannamei hatcheries and performance is at par with imported feeds.



### Source

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## COST-EFFECTIVE DESI SHRIMP FEED: VANAMI<sup>PLUS</sup>

3

Feed cost is the major component in the grow-out culture of vannamei shrimp. Commercially available feeds are expensive. ICAR-CIBA has developed a cost effective indigenous feed using locally available ingredients. This is a boon for small and medium shrimp farmers.

### Scope

At present, more than 90% of the shrimp farming depending on selectively bred exotic *Penaeus vannamei* species. Its unique feeding behaviour and nutrient requirements offers an opportunity for effective utilization of nutrient resources and natural feeds. To convert this advantages in to profit by a farmer, a unique feed like Vanami<sup>Plus</sup> would be an sustainable option.

### Cost

Eighty lakhs to three crores for machineries based on the level of production and automation plus working capital required @ Rs.40,000/- per ton of feed.

### Benefits:

- Scientifically formulated quality feed for vannamei.
- Cost ranges from Rs. 55-65/-.
- Increases the profit margin for farmers by 15-20%.
- Tested and evaluated extensively in farmer's ponds.
- FCR of 1.2-1.5.
- Eco-friendly feed with better soil and water quality.
- Customizable technology for small, medium and large scale operations.
- Suitable for corporate entrepreneurs, farmer clusters and co-operative societies.
- Capital investment for the feed production unit is Rs. 50-150 lakhs based on the infrastructure and production target.



### Source

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## SEA BASS GROWOUT FEED: SEEBASS<sup>PLUS</sup>

Asian Seabass, also known as Barramundi, is a high value, fast growing food fish, which is highly carnivorous and predatory in nature. ICAR-CIBA identified Seabass as a candidate fish for farming in brackishwater for diversification farming. Feeding such a carnivore sea bass is challenging in its farming, in terms of feed acceptance as well as feed cost. As outcome of continuous research, CIBA developed a cost effective feed for sea bass and branded it as “Seebass<sup>Plus</sup>”.

### Scope:

Cost effective feed is the bottleneck in expansion of seabass farming in India. Seebass<sup>Plus</sup> technology could be great support for seabass farming in ponds, cages and in recirculating aquaculture.

### Cost

Rs. 1.5 crore for a sinking feed through pellet mill and 2.5 crore for a floating slow sinking extruder feed mill.

### Benefits:

- Scientifically formulated balanced formula for seabass.
- Feed with good attractability and palatability.
- Cost effective feed prepared using indigenous ingredients.
- Nominal cost of feed @ Rs. 75-85/- per kg depending on the fat content.
- Extensively field tested with FCR of 1.4-1.8 in grow-out phase.
- Suitable for nursery and grow-out culture.
- Nursery feeds from 500 - 1500  $\mu$ .
- Grow-out feeds available from 1.8 to 8.0 mm pellets.
- Suitable for feeding in pond and cage culture.
- Technology ready for commercialization on non-exclusive basis.



### Source

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Poly culture of finfish is a traditional low input activity in India. Brackishwater aquaculture sector has tremendous resources and potential for sustainable development of aquaculture using polyculture models. Though feed will be a requirement in polyculture for linking the food chain with in the system, feed utilization will be complete, compared to any other aquaculture system.

### Scope

Developing commercial feeds suitable for polyculture needs unique formula for cost effectiveness better utilization of the resources. This cost effective Poly<sup>Plus</sup> will be of great support to the sector and rural sustainable aquaculture.

### Cost

Rupees 15 to 25 lakhs based on the production capacity plus working capital required @ Rs. 25, 000/- per ton of feed.

### Benefits:

- Suitable low cost feed for polyculture.
- Developed using locally available ingredients.
- Use of fish meal reduced to 10%.
- Shelf life of about 2 months.
- Uses simple processing methods.
- Highly suitable for small farmers.
- Productivity up-to 4764 kg/ ha and FCR 1.32 (325 days).



### Source

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## HAPA BASED NURSERY REARING FOR ASIAN SEABASS (*Lates calcarifer*)

Hapa based nursery rearing can be carried out in natural water bodies or in the ponds to produce seabass fingerlings (3-4 inches) from fry size (1 to 2 cm). This method is advantageous than other methods since the management is easier and installation of rearing facility requires less space and capital investment. It can be also extended to any scale depending on the necessity and the capability of the farmer. Fixed hapas can be in the size of 2.0 x 1.0 x 1.0 m depending upon necessity. Fry can be stocked @ 400 – 500/m<sup>2</sup> and feeding can be done with CIBA farm made nursery feed. Regular grading should be done to avoid cannibalism and increase the survival rate. After 60-75 days of rearing, farmers can get the fingerlings with 60-75% survivability rate.

### Scope

Huge demand for seabass fingerling seed exists among the farmers in order to stock in the pre-growout pond or in the cages. Recently, cage culture of seabass has become very popular among the farmers and seed requirement is in the increasing trend.

### Cost

With the investment of Rs. 5.0 lakh, farmers can get total revenue of Rs.12.0 lakhs, with a net profit of Rs.7.0 lakh/ annum.

### Benefits

- Easy to practice in the open water body for the farmers, who do not have the pond.
- Nursery rearing can be done in a short period and revenue can be generated within two months.
- More culture area is available for seabass farming and the seed demand is growing, which ensures good price for the farmers.



Seabass fingerlings



Hapa rearing

### Source

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# SEABASS HATCHERY TECHNOLOGY FOR SEED PRODUCTION

ICAR-CIBA has standardized breeding and seed production technology for Asian Seabass (*Lates calcarifer*) for the first time in India in the year 1997 and over the years the technology has been tailored to achieve year round seed production with and without hormonal manipulation in RAS based systems to make sure the seed availability to the farmers throughout the year. Seabass hatchery technology has been transferred to MPEDA-RGCA during 2000 as a part of transfer of Technology. Besides, CIBA is distributing 1.5 to 2.0 million seabass seed annually to farmers in coastal states of Kerala, Tamil Nadu, West Bengal, Andhra Pradesh, Maharashtra, Karnataka, Odisha, West Bengal, Gujarat etc. for farming, which has resulted in boosting of seabass production in the country.

## Scope

Huge demand exists for seabass seed amongst the farmers in order to diversify the farming practices as this species can be farmed either in pond or cages in varying salinity from 0 to 35 ppt and is a highly preferred fish in the domestic market.

## Cost

With an investment of 3.0 to 4.0 crores by the entrepreneurs, 5 million seabass seed, can be produced in the hatchery with the annual gross income of Rs. 1.0 to 1.5 crore and net income of 50 to 75 lakhs.

## Benefits

- Ready market since huge demand for seed from the farmers.
- Market available for different size seed like spawn and early fry, late fry and fingerlings.
- Technologies on seed and feed production and health management are available.



Adult Seabass



Seabass early fry

## Source

The Director, ICAR-Central Institute of Brackishwater Aquaculture, 75, Santhome High Road, R. A. Puram, Chennai – 600028, Ph. No.: +91 44 24617523 (Director)/ 24616948/ 24610565/ 24610311, Fax No.:+91 44 24610311, E-mail: director@ciba.res.in.

## TECHNOLOGY OF LOW VOLUME CAGE CULTURE OF ASIAN SEABASS

Backwaters of country provide ample opportunity to small scale fish farmers to indulge in brackishwater farming, yet the same remain unutilized due to non-availability of specific culture technology suiting the environment of backwaters. Hence, ICAR-CIBA has standardized a model of Asian Seabass rearing in low volume floating cages. These cages can be installed in open waters with mooring systems and can be stocked with seabass fingerlings. Within 8-10 months of culture operation, 0.5–1.5 kg fishes can be harvested with a productivity of 19.8 kg/m<sup>3</sup>.

### Scope

- Low volume cage culture can be taken up by the individual or as group where the water depth can be 2.0 to 3.0 meter or more.
- Seabass is highly suitable for cage culture and attain rapid growth rate.
- Ready market is available for 1.0 kg and above, and possible for live fish market.

### Cost

The total cost of the project (24 m<sup>2</sup> cage size) would be Rs.1.05 lakhs and the total revenue can be generated with Rs.1.90 lakh by selling 450 kg of seabass @ Rs.400/- per kg, with a net profit of Rs. 85,000/-.

### Benefits

- This technology benefits farmers, women SHG's and SHG's working in open backwaters.
- Major inputs seed and feed are available.
- Seabass has ready market.



Seabass harvesting from cage

### Source

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## HATCHERY TECHNOLOGY FOR SEED PRODUCTION OF MILKFISH (*Chanos chanos*)

Milkfish (*Chanos chanos*) is one of the most popular cultivable brackishwater finfishes in the south-east Asian countries and are widely distributed in the Indo-Pacific region. It is called as *Paal Meen* in Tamil, *Pala Bontha* and *Tulli Chepa* in Telugu, *Poomeen* in Malayalam, *Hoomeenu* in Kannada. Milkfish is herbivorous in feeding habit. Culture of milkfish in brackish water ponds and pens is an age-old traditional practice in many tropical countries including India and productivity can be achieved @ 4.0 to 4.5 tonnes/ ha. Milkfish can attain the table size weight from 400 to 500 gm in 5-6 with the production cost of Rs. 80-90/- per kg. It can fetch the market price from Rs. 150 to Rs. 200/- per kg domestic markets especially in Kerala, West Bengal and Goa. ICAR-CIBA has made major breakthrough on captive breeding of milkfish for the first time in India during June 2015 and developed comprehensive technology package for seed production.

### Scope

It has low disease occurrence and it can withstand wide range of salinity (0-40 ppt). Being herbivore, milkfish feeds on plankton, benthic algae, detritus matter in the natural condition and easily accepts the pellet feed under culture condition and cost of production would be between Rs. 80-90/- per kg. Formulated pellet feed is available for fry, fingerlings and grow out stage.

### Benefits

- Farmers can take up milkfish farming either by monoculture or by polyculture.
- It is an ideal species for small and medium scale farmers since the capital investment is less.
- Being bony fish and similar to Hilsa, it has good market in West Bengal and North eastern states.



Adult Milkfish



Milkfish fry

### Source

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## MODULAR SYSTEM BASED SEED PRODUCTION TECHNOLOGY OF PEARLSPOT

ICAR-CIBA has developed modular tank system for pearlspot breeding and seed production using a single pair. The modular tanks are made up of plastic with 1.0 t capacity. The tanks are provided with mild aeration and a gentle flow is maintained using a bio-filters based re-circulatory aquaculture system. Feeding of brooders is done to satiation using pearlspot broodstock feed *Etro Brood Plus* twice a day. Breeding frequency is optimized by curtailing parental care and specialized broodstock feeds. Larvae can be reared on live feeds and gradually weaned to formulated feeds. A total of 1000 fry (2.0 cm size) can be obtained in 30 days period and annual total production of up-to 12000 seed per tank can be achieved.

### Scope

Pearlspot can be used both for food as well as for ornamental purposes. The fish has very good market in Kerala. Being omnivore, its protein requirement is less and total production cost also would be lesser. The seed requirement for farming in Kerala is plenty and fetching 2 inch size seed for Rs. 8-10/-.

### Cost

The total project cost would be Rs. 1.59 lakh. The cost of production per seed worked out was Rs. 2.20/-. A total of Rs. 2.52 lakh can be generated by selling 72000 no. of seeds @ Rs. 3.50/- per seed. The net profit would be Rs. 93, 000/- per annum with monthly net income of Rs. 7,750/-.

### Benefits

- It requires 2-3 cent area of land to establish the breeding unit as house hold activity.
- The water requirement would be less, since recirculation aquaculture system can be adopted in salinity varying from 0 to 30 ppt.
- It require daily one to two hours work and can be take up as part time activity by the family members.



Pearlspot



Pearlspot breeding Unit (RAS)

### Source

The Director, ICAR-Central Institute of Brackishwater Aquaculture, 75, Santhome High Road, R. A. Puram, Chennai – 600028, Ph. No.: +91 44 24617523 (Director)/ 24616948/ 24610565/ 24610311, Fax No.:+91 44 24610311, E-mail: director@ciba.res.in.

# SEED PRODUCTION TECHNOLOGY FOR BRACKISHWATER ORNAMENTAL FISHES SPOTTED SCAT (*Scatophagus argus*)

ICAR-CIBA has developed a pond based captive broodstock and standardized seed production technology for spotted scat through hormonal manipulation. Captive broodstock scat fishes in the size range of 50-400 g can be maintained in earthen pond. Fishes can be fed with formulated feed @ 2-3% once a day. Matured female and male fishes could be examined having initial oocyte diameter of above 400  $\mu\text{m}$  and oozing males can be selected for breeding trials. Females were administered with HCG hormone and half of the dose for males. Stripping method can be followed for facilitating fertilization. Scat larvae can be reared feeding with live feeds initially and thereafter with artificial feed. One inch marketable size scat juveniles can be produced in 60 days period in the hatchery.

## Scope

Brackishwater ornamental fishes like spotted scat has huge demand, amongst the hobbyists because of its unique colour pattern. The scat has good market demand both in domestic markets and as well as in the international market for aquarium purpose.

## Benefits

- Spotted scat has huge potential for export with continuous supply.
- The fish mature in the brackishwater pond condition and easy to maintain the brooders.
- Ready market is available for both ornamental and grows-out culture for food purpose.
- Technology on seed and feed production and health management are available readily.



Adult spotted scat



Juvenile scat

## Source

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## *Enterocytozoon hepatopenaei* (EHP) NESTED PCR KIT

The microsporidian parasite *Enterocytozoon hepatopenaei* (EHP) is a newly emerging pathogen of cultured shrimp in aquaculture sector. The economic loss due EHP infection is rapidly growing, and is now considered to be a critical threat to shrimp aquaculture in India. Recently, the disease has spread widely in cultured *Penaeus vannamei* and *P. monodon* grow-out farms. The disease is considered next to white spot syndrome virus (WSSV) in terms of prevalence and is causing severe growth retardation and production loss to the extent of 15-20%. ICAR-Central Institute of Brackishwater Aquaculture (Chennai) has developed a nucleic acid based PCR kit for diagnosis of EHP infection in shrimp broodstocks, post larval seeds and cultured shrimp.

### Scope

Diagnosis of *Enterocytozoon hepatopenaei* (EHP) infection in shrimp.

### Cost

The total cost (including civil structure, manpower, molecular reagents, equipment and other resources) to be required to commercially manufacture of this diagnostic kit is Rs. 30 lakh and it is yet to be commercialized.

### Benefits

- Ready to use screening kit to detect EHP microsporidian parasite of shrimp.
- First and second step PCR in two tube format using same amplification cycle.
- In-built internal control amplification system.
- Suitable for screening of whole post larvae and hepatopancreas of grow-out shrimp.
- Non-lethal screening of broodstock using faecal sample.
- Cost effective and sensitive with detection limit of 10 copies.
- Useful for PCR testing laboratories.
- Useful for commercial shrimp hatcheries.
- Useful for Department of Fisheries of State Government and various institutions pertinent to shrimp aquaculture.



### Source

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## IMPROVED PCR KIT FOR DIAGNOSIS OF WHITE SPOT SYNDROME VIRUS (WSSV)

The white spot syndrome virus (WSSV) is the causative agent of white spot disease (WSD) in shrimp. It is the most virulent, fast replicating and widespread shrimp pathogenic virus causing high mortality and severe economic loss to the global penaeid shrimp farming industry. It causes rapid mortality about 90% to 100% within 3-10 days after infection. WSD has emerged as the greatest threat to global crustacean aquaculture industries from 1994. ICAR-CIBA is a lead research institution in the area of aquatic animal health in India and involved in development of fast, accurate and cost effective diagnostic kits for major shellfish and finfish pathogens in India. In this effort the institute has developed a WSSV diagnostic kit with two tube nested PCR assay.

### Scope

Diagnosis of White Spot Syndrome Virus (WSSV) infection in shrimp.

### Cost

The total cost ( including manpower, molecular reagents, equipment and other resources) to be required to develop this diagnostic kit is Rs. 30,00,000/- and it is has been commercialized to 2.5 lakhs on non-exclusive basis.

### Benefits

- Specific and sensitive detection of WSSV infection.
- The kit can detect as low as 10 copy numbers in the clinical samples.
- Cost effective, user friendly and can be performed consistently.
- Includes a house keeping gene to nullify any chances of false negative results.
- Diagnostic result can be obtained in 5-6 hours.
- Useful for PCR testing laboratories.
- Useful for commercial shrimp hatcheries.
- Useful for Department of fisheries of state government and various institutions pertinent to shrimp aquaculture.



### Source

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## AMMONIA AND NITRITE KIT

In aquaculture and related aquatic environment, ammonia and nitrite are very important parameters, and to be monitored regularly in order to maintain optimum water quality in the system. Any increase in the concentration of these parameters negatively affects the survival of aquatic species. Regular monitoring of ammonia and nitrite using this kit will help aquafarmers and hatchery operators to maintain these critical parameters at optimum levels.

### Scope

Estimation of ammonia and nitrite in open water bodies and aquaculture ponds.

### Cost

The total cost (including manpower, equipment and all other resources) to be required to complete implementation of this innovation is Rs. 1, 00,000/-and the license fee will be Rs. 2.0 lakhs. It has been commercialised to M/S Shrimpex, Chennai, on non-exclusive basis.

### Benefits

- Range varies from 0.1 to 5 ppm.
- Higher accuracy and sensitivity.
- Fewer requirements of water samples.
- Increased shelf-life of the reagents.
- Cost effective.
- Wider range of detection and can be used in freshwater, brackishwater and coastal waters.
- Useful for aqua-farmers and hatchery operators for regular monitoring of these critical parameters.
- User-friendly and easy to use in the laboratories and field.



Ammonia and nitrite kit commercialised to M/S Shrimpex, Chennai, Tamil Nadu

### Source

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## PH AND DO KIT

15

The pH and dissolved oxygen (DO) are the critical water parameters to be maintained in optimum range for successful growth of aquatic species. The kit has been developed for measurement of pH and DO parameters in aquaculture ponds, hatcheries and related aquatic environment.

### Scope

Estimation of pH and DO in open water bodies and aquaculture ponds.

### Cost

The total cost (including manpower, equipment and all other resources) to be required to complete implementation of this innovation is Rs.1.5 lakh in addition to license fee of Rs. 2.0 lakhs.

### Benefits

- Based on the colour chart and number of drops.
- pH ranges from 2 to 10.
- Higher accuracy and sensitivity.
- Less requirement of water sample.
- Increases shelf-life of the reagents.
- Cost effectiveness.
- Wider range of detection and can be used in freshwater, brackishwater and coastal waters.
- Useful for aqua-farmers and hatchery operators for regular monitoring of these critical parameters.
- User-friendly and can be used in the laboratories and field.



pH and DO kit commercialised to M/S Fisherman's, Bhopal, Madhya Pradesh



### Source

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## CMH MINERAL KIT

Estimation of calcium and magnesium is very important in *Penaeus vannamei* culture ponds in order to decide the mineral supplementation. Mineral supplementation in shrimp culture ponds especially in *P. vannamei* advocated by consultants to compensate for limiting mineral ions and improve growth and production. As a matter of fact, most of the minerals are not limiting in the pond waters of varying salinity as proven by scientific studies. Unaware of the ionic composition, especially of calcium and magnesium in pond waters, shrimp farmers apply minerals. Of late, due to the awareness created among farmers in order to reduce the cost of production, many are interested to estimate these ions in the pond waters during culture period.

### Scope

Estimation of calcium, magnesium and total hardness in open water bodies and aquaculture ponds

### Cost

The total cost (including manpower, equipment and all other resources) to be required to complete implementation of this innovation is Rs. 2.0 lakhs in addition to license fee of Rs. 3.0 lakhs.

### Benefits

- Higher accuracy and sensitivity.
- Less requirement of water sample.
- Increases shelf-life of the reagents.
- Cost effectiveness.
- Wider range of detection in waters of varying salinity.
- Useful for aqua-farmers and hatchery operators for regular monitoring of these parameters.
- User-friendly and easy to use in the laboratories and field.



### Source

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# CIBA-PHOSPHOSORB

Most of the wastewaters from aquaculture facilities and other anthropogenic and industrial activities are rich in phosphate and creates eutrophication in the receiving water bodies, if not treated. To reduce the phosphate level before releasing into the environment, a clay mineral based adsorbent, “CIBA-Phosphosorb”, has been developed by ICAR-CIBA.

## Scope

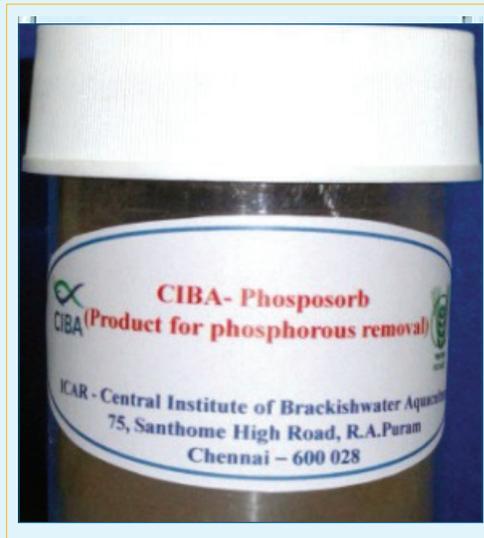
Removal of phosphate from effluents/ wastewaters rich in phosphate.

## Cost

The cost for preparation of 1 kg of the product is Rs. 400/-. The total cost (including manpower, equipment and all other resources under large scale) to be required to complete implementation of this innovation is Rs. 1.5 lakh in addition to license fee of Rs. 2.0 lakhs.

## Benefits

- Effective for removal of phosphate in waters with salinity of 0-35 ppt.
- Higher efficiency at lower salinity.
- Mitigation of algal bloom and prevents eutrophication.
- Cost effective.



CIBA-Phosphosorb

## Source

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## CIBAMOX

Modern semi-intensive and intensive shrimp aquaculture practices result accumulation of toxic wastes in pond environment. Accumulation of nitrogenous wastes like ammonia, nitrite and nitrate leads to poor growth and death in grow-out shrimp culture systems, in addition to increasing susceptibility to infectious agents. Further, discharges from these aquaculture farms pose serious environmental threat. Microbes are known to metabolize the environmental toxins and their industrial production and application has been well documented. In the similar lines, consortia of ammonia oxidizing bacteria, nitrite oxidizing bacteria and denitrifying bacteria have been developed and their industrial scale production have been standardized. Controlled laboratory and extensive field trials have shown that weekly application of the product @ 5 lit/ha maintains the level of ammonia, nitrite and nitrate below the permissible limits. Extensive field trials, conducted in Andhra Pradesh, Tamil Nadu, Gujarat and Odisha, have shown the performance of the product under commercial farming conditions. Three companies, which were involved in filed evaluation of the product, have expressed their interest for acquisition of the technology from CIBA.

### Benefits

The “CIBAMOX” technology, developed in ICAR-CIBA, has the innovative combination of ammonia oxidizing bacteria, nitrite oxidizing bacteria and denitrifying bacteria. These isolates have been selected for faster growth and higher detoxification efficiency. The product has proved its effect in controlled laboratory experiments and extensive field trials conducted in major coastal states of the country.

### Cost

- The total cost (including manpower, equipment and all other resources) to be required to complete implementation of this innovation is Rs. 5.0 lakh in addition to license fee of Rs. 2.0 lakhs. The cost of production is approx. Rs. 100.00/- per litre.
- Services offered as part of the technology transfer- Up-to 5 persons nominated by the licensee shall be trained for the period up-to 5 days. Cost of training to be imparted by the Institute is included in the licensing fee.

*\*\*All statutory compliances related to production, sales, transportation and storage have to be fulfilled by the licensee.*



### Source

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## CARRYING CAPACITY ESTIMATION OF WATER BODIES: A TOOL FOR AQUACULTURE PLANNING

A key element in many definitions of sustainable aquaculture development is to stay within the “carrying capacity” of the environment and it should be assessed. Carrying capacity of many source waters has been exceeded or likely to exceed due to haphazard and over development of shrimp farming and low tidal amplitude in Andhra Pradesh and Tamil Nadu resulting to in negative impacts of poor productivity and occurrences of diseases. There is a lot of potential area for development of shrimp farming in many states especially Gujarat and West Bengal. In order to attain the sustainable aquaculture development, it is essential to regulate further or plan new development based on the carrying capacity of water bodies.

### Scope

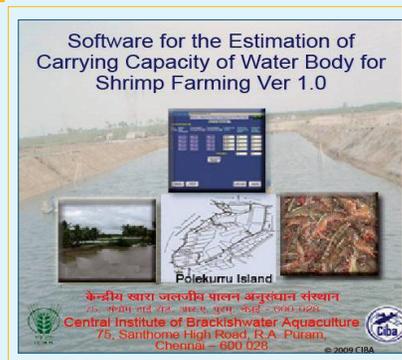
- State governments and regulatory organizations to regulate the level of aquaculture activity on a particular water body.
- Private entrepreneurs and farmers’ cluster groups who would like to develop large areas for aquaculture.

### Cost

Software was developed for the estimation of carrying capacity of water bodies based on the maximum nutrients loading which can be assimilated by the water body without exceeding the permissible levels of water quality. As the length of water bodies and aquaculture development varies, costing varies for each water body and quote will be given on request.

### Benefits

Carrying capacity based developmental planning guide the agencies for providing recommendations on the area to be taken up for culture on a particular water body. This tool is useful for state governments and other regulatory organizations in framing future guidelines and policies for environmentally compatible and sustainable development of shrimp farming. For private entrepreneurs and farmers’ cluster groups who would like to develop large areas for shrimp farming, this software can be used as a planning tool in order to not to exceed the carrying capacity of the receiving water body.



### Source

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## CULTURE OF PACIFIC WHITE SHRIMP (*Letopenaeus vannamei*) IN INLAND SALINE WATER

The major challenges encountered for *L. vannamei* culture were the quality of ground saline water because of its ionic imbalance. The cultivation of *L. vannamei* has been standardized following similar practise of pond preparation for shrimp culture with little modification. The pond water was fortified with commercial grade murate of potash to maintain optimum potassium level and no lime was applied due to high pH of the water. The salinity was maintained in the range of 13-15 ppt. The ponds were fertilized with fermented organic slurry prepared with molasses, rice bran, oil cake and the ponds were stocked with *L. vannamei* SPF post larvae @ 55 nos./ m. Commercial shrimp feed was used *ad libitum* for feeding the animals. The feeding schedule was prepared based on the estimated biomass obtained from the weekly sampling. The water quality parameters like salinity, pH, dissolved oxygen, hardness, calcium, magnesium, alkalinity and potassium were maintained within the suitable range require for culture. An adequate number of mechanical aeration units and sometimes soil and water probiotics were used for the maintenance of the desired water quality and upkeep of pond bottom health. A total production of 13.4 tons/ ha could be obtained in 120 days.

### Scope

Coastal area of West Bengal and Andaman & Nicobar Islands.

### Cost

Contact to the Director of the Institute\*.

### Benefits

As the vast stretch of agriculture land has become saline and unfit for any agricultural activity, the farmers can undertake *L. vannamei* culture for 100-120 days like any other agriculture crop and reap an enormous profit.



### Source

\* The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## TIGER SHRIMP FARMING IN SALINE AFFECTED AREAS

Tiger shrimp (*Penaeus monodon*) does not survive in inland saline water due to difference in the chemistry of water with that of seawater. The cause of mortality was assessed through bioassay trials and it was found that poor concentration of potassium in saline water was mainly responsible for mortality. Based on indoor experiments, field trials were carried out at high saline Baniyani Farm (CIFE Regional Centre, Rohtak) during the year 2008 in two non-drainable ponds of size 0.25 ha each lined with polyethene sheets to prevent seepage and placed with 0.30 m thick layer of soil. These ponds were fed ground saline water of salinity 12 ppt from a bore well. The level of potassium was enhanced in saline water by adding muriate of potash (fertilizer grade) around 50% equivalents to coastal seawater. The methods of husbandry remained the same as that of coastal farms. A production 2.7 tons/ ha in 110 days at a stocking density of 10 PLs/ m could be obtained.

### Scope

Coastal area of West Bengal and Andaman & Nicobar Islands.

### Cost

Contact to the Director of the Institute\*.

### Benefits

Interception of ground saline water for utilizing in pond aquaculture, lowers the ground table and help in soil improvement and reduction in secondary salinization. Like agriculture, a crop of tiger shrimp is of 4 months duration and hence farmers may harness returns in a short time and can take two crops in a year during warmer climate of 8 months (March- November).



### Source

\* The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## MUD CRAB CULTURE AND FATTENING IN TIDE-FED BRACKISH WATER POND

Mud crabs can be cultured in brackish water ponds and places adjacent to mangrove areas or saline affected soils where water level to be maintained around 75 cm. Grow-out ponds can be constructed in tide fed estuaries, backwaters and creeks. A 3.5 feet high bamboo fencing on the bundh is essential to prevent escape of crabs from the pond. A pond of 0.1 ha area can be used for mud crab culture. Mud crab juveniles are to be collected from mangrove areas with the help of lift net and stocked. Mud crab *Scylla serrata* is to be stocked in 0.1 ha earthen pond fenced with bamboo mat at a stocking density of 5000 nos/ ha. The crabs can be regularly fed with trash fishes and chicken offal. With 5000 numbers/ ha stocking density of 50-60 g size crab for a period of four months, about 900 kg/ ha production can be achieved. Materials/ equipments to be required are namely bamboo mats for fencing, pH meter, weighing balance, liftnet, trash fish etc.

### Scope

After tsunami a vast coastal area is available in Andaman & Nicobar Islands, which remains hitherto unused. The unemployed youth, tsunami affected farmers and private entrepreneurs of the Islands can profitably use mudcrab culture for gainful employment.

### Cost:

Total cost is Rs. 3, 56,000/- with existing pond maintenance (Rs. 75,000/- for juveniles @ Rs. 15/- juvenile for 5000 nos; Rs. 75,000/- for feed, Rs. 81,000/- for pond construction and Rs. 1,25,000/- for bamboo fencing and labour).

### Benefits

With a production of 900 kg/ ha @ Rs. 400/- per kg an overall income of Rs. 3, 60,000/- can be generated. Therefore, in the first year, a net profit of (Rs. 3,60,000/- - 3,56,000/-) = Rs. 4,000/- can be obtained; however, from the second cycle onwards, a net income of Rs. 1,30,000/- can be obtained.



A tide fed brackish water pond with bamboo mat fencing and harvested mud crab after four month culture



### Source

The Director, ICAR-Central Inland Agricultural Research Institute, Post Box No. 181, Port Blair- 744 101, Andaman and Nicobar Islands, India.

# CULTURE AND FATTENING TECHNOLOGY OF MUD CRABS

The pond design includes hideout pipes, earthen mounds, bamboo baskets and *Gracilaria* plants for use as shelter for growing crabs. Pond bundhs should be fenced with net to prevent migration. The crab seed stocking densities were maintained 0.5 to 12 crab/ m. Fresh trash fishes were given as supplementary feed at the rate of 3-5% of body weight of crab twice a day. Cropping period was observed for 120 to 150 days. A total production of 600 kg/ ha/ crop could be achieved in case of *Scylla serrata* and about 900 kg/ ha/ crop in case of *S. tranquebarica*.

Crab fattening- Rearing of water crabs in suitable earthen ponds, pens and cages for a period of 3-5 weeks is known as fattening. The crabs harvested from ponds or mangrove forests may include some growing crabs which remain very soft and pulpy- these are known as water crabs. Such crabs have no market value and are needed to be cultured for some more time in a separate water body. Fattening is the process wherein water crabs are subjected to culture for a period of 3-5 weeks to become hard shelled crabs. These hard shelled crabs are mixed with other marketable crabs to fetch a market price ranging from Rs. 200-500/ kg depending on size range of 400-800 g.

## Scope

The technology is highly suitable for Andaman & Nicobar Islands and coastal as well as southern region of West Bengal.

## Cost

Contact to the Director of the Institute\*.

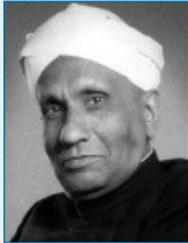
## Benefit

Owing to domestic as well as export demand, the crab culture has gained momentum. ICAR-CIFE, Mumbai has initiated a package of practices for crab culture and fattening using two major varieties of crabs, *Scylla serrata* and *Scylla tranquebarica* with variable stocking densities.



## Source

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Success can come to you by courageous devotion to the task lying in front of you.

- C V Raman

# CHAPTER 2

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## Fresh Water Aqua Culture



My success will not depend on what A or B thinks of me. My success will be what I make of my work.

- Homi J Bhabha

Pen culture of fishes involves holding fishes as captive stock within an enclosed space made up of split bamboo/HDPE net supported bamboo poles under human management for short or long duration. The HDPE net pen will last for 3 years. Circular pen with recommended area for a single pen unit is 0.1- 0.2ha; fry of Indian major carps and exotic carps (40-50 mm) are stocked in pens for raising them up to advanced fingerling stage (100-150 mm). Depending upon trophic status of ecosystem, the stocking density of 2.5-3 lakhs/ ha with suitable species ratio is maintained without supplementary feeding. With a survival of 60-70%, the production of fish seed of Indian major carps expected is 3000-4000 kg/ ha in 3 months of rearing depending on the agro-climatic area and local conditions. Two crops of advanced fingerlings could be produced in the first year and three crops in the following years.

## Scope

Floodplain wetlands, ox-bow lakes and marginal areas of reservoirs.

## Cost

The capital cost for 0.1 ha is Rs. 11,350/- (HDPE pen) and recurring cost is Rs. 35,720/-.

## Benefits

The net benefit is Rs. 29,688/- in the first year while Rs. 58, 957/- in the 2<sup>nd</sup> and 3<sup>rd</sup> year.



## Source

The Director, ICAR-Central Inland Fisheries Research Institute, Barrackpore, Kolkata-700120, West Bengal.

## BREEDING AND MASS SCALE SEED PRODUCTION OF MAGUR (*Clarias batrachus*)

*Clarias batrachus*, an indigenous catfish popularly known as magur in India commands a good market value. Due to high larval mortality of this species under captive condition, a standard package of practices were developed to increase the survivability in mass scale seed production. A new system of fertilization with healthy brooder under flow has been standardized with high conception rate. The standard rearing system of fry with optimum survivability was developed by maintaining stocking density, water hygiene management, proper feeding and health management. The feed particle size and quantity was optimized for proper development of fry of magur.

### Scope

It is suitable for every agro climatic zone of India.

### Cost

Contact to the Director of the Institute\*.

### Benefit

It has high market demand and less production in Eastern and North Eastern states of India fetching above Rs. 600/- per kg. The technology will help in seed production to boost commercial culture of Magur.



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

Or

The Scientist-In-Charge, ICAR-Central Institute of Fisheries Education (Deemed University), Kolkata Centre, 32-GN Block, Sector-V, Salt Lake City, Kolkata-700091, Tel: 033-23573893/7265/5269, Fax: 033-23573469, Website: [www.cife.edu.in](http://www.cife.edu.in).

## SEED PRODUCTION TECHNOLOGY OF *Anabas testudineus*

The climbing perch, *Anabas testudineus* is popular food fish having high market demand. Lack of seed has always been the bottleneck for mass scale culture of *Anabas*. Male (> 25 g) and female (>30 g) brooders weighing more than 25 g are selected for breeding during March – August. Synthetic hormones are given at the rate of 2 cc per kg. Two to three days' old larvae are reared in circular tubs or tanks with 15-20 cm water depth. Larvae are fed with Rotifer, *Artemia nauplii*, *Moina* in sequential manner till 15<sup>th</sup> day when Tubifex is given till satiation. Artificial larval diets of 250-500 micron size may be given after 15<sup>th</sup> day onwards with 50% water exchange till 30<sup>th</sup> day before transferring to nursery tanks. Care is taken to segregate the fast growing shooters of more than 20 mm length to avoid cannibalism. After 30 days of larval rearing, the fry is ready for stocking in hapas in ponds with artificial feed containing more than 30% protein.

### Scope

It has tremendous scope in West Bengal.

### Cost

Income from breeding of 20 kg brood stock-

- Total income is Rs. 50,000/- (One lakh fry @ Rs. 0.50 per fry).
- Recurring expenses is Rs. 41,000/-.
- Non-recurring expenses is Rs. 1,90,000/-.
- Net Profit is Rs. 15,000/- (3 months).

### Benefits

It has high market demand in Eastern and North-Eastern States of India fetching above Rs. 500.00 per kg. The technology will help in local seed production to boost commercial culture of *Anabas*. It will help in species diversification in aquaculture to utilize low lying swampy areas to enhance fish production.



### Source

The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

Or

The Scientist-In-Charge, ICAR-Central Institute of Fisheries Education (Deemed University), Kolkata Centre, 32-GN Block, Sector-V, Salt Lake City, Kolkata-700091, Tel: 033-23573893/7265/5269, Fax: 033-23573469, Website: [www.cife.edu.in](http://www.cife.edu.in).

## GIANT FRESHWATER PRAWN SEED PRODUCTION USING ARTIFICIAL SEA WATER

In order to meet the requirement of saline water for completion of life cycle of giant fresh water prawn, a chemical formula has been prepared with six major, six minor and six trace salts to prepare artificial sea water. Since most of the minerals and trace salts are available in natural freshwater, a simple formula with seven major salts has been prepared keeping salinity at 12 ppt. The salts are to be mixed one after other with thorough aeration and is to be kept for 2-3 days with aeration. Then, water is to be filtered and to be used for the operation of giant fresh water prawn hatchery. The hatchery operation is same as that to be followed in the natural sea water hatchery.

### Scope

It is most suitable technology for all the non-coastal area.

### Cost

Contact to the Director of the Institute\*.

### Benefits

The establishment of prawn hatcheries in the Inland states will help in production of quality seeds locally and enhance the productivity which in turn improves the socio-economic status of farmers and entrepreneurs. Various Government and Semi-Government Organizations, NGOs, entrepreneurs and farmers can get benefit out of this technology.



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## SCAMPY SEED PRODUCTION USING INLAND GROUND SALINE WATER

Seawater is essential for the survival and growth of prawn larvae. Transportation of seawater/ brine to land-locked areas is not only difficult and costly but also bio-unsecure. Technology has been developed to use inland ground saline water as a replacement media for seawater. A prawn hatchery at inland saline site requires all infrastructure facilities similar to that of a coastal hatchery with additional facility amending water quality and a saline water bore well having water salinity of more than 12 ppt. The water drawn from the saline aquifer is generally free from suspended particles and pathogens and hence unlike seawater does not require large scale remediation. The optimum levels of calcium, potassium and magnesium required by prawn larvae in ground saline water have been standardized and a simple protocol for amending the ground saline water has been developed. In this protocol the level of calcium in saline water of 12 ppt is reduced through deionization process. The levels of potassium and magnesium are maintained by supplementation with commercial grade/ fertilizer grade salts.

### Scope

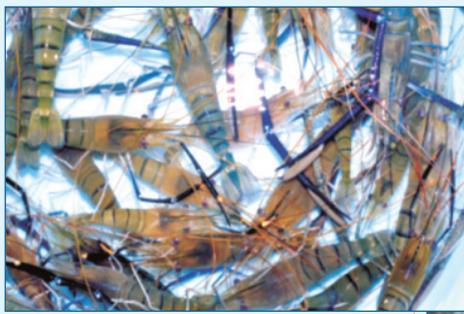
Andaman & Nicobar Islands and coastal area of West Bengal.

### Cost

Contact to the Director of the Institute\*.

### Benefits

The prawn seed produced with saline water is bio-secure, cheap and healthy which will further provide job opportunities, self-employment and income generation to the farmers whose lands have become saline and lying fallow. Extraction of saline water will help in lowering down the water table and curb water logging conditions in the area.



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## CAGE CULTURE FOR RAISING FISH SEED AND TABLE FISH

Cage culture of fishes involves holding fishes as captive stock under human management. A cage can be fabricated using bamboo or MS frame of rectangular, square or circular shape. Square shaped cage with volume 50-105 m<sup>3</sup> of a single cage unit is recommended; battery of such units can be installed as required. Areas suitable for cage installation are protected bays in reservoirs, deeper portion of floodplain wetlands and lakes where water depth should be >5 m. The cage can be ideally utilized for raising fry to advanced fingerlings of carps and/or production of table fishes. The stocking density depends on the species and size of the fish. Major carp fry of 40-50 mm can be stocked @25-30 numbers/ m<sup>3</sup> of cage for production of advanced fingerling (100-150 mm). Fast growing catfishes like *Pangasius sutchi* can withstand high stocking density of 50-70 numbers/ m<sup>3</sup> for grow-out culture. Two crops of carp seed and one crop of *P. sutchi* can be taken in a year. Carp fingerlings are raised using stable compact pellet (30% CP) through tray feeding method while extrusion pellet (25-30% CP) is required for growing table fish of *P. sutchi*.

### Scope

Reservoirs and deep ox-bow lakes. Warmer climate is highly suitable for table fish farming of *P. sutchi*. Water temperature below 15°C may prove detrimental for this species.

### Cost

Capital cost of Rs. 50,000 /- for single unit of 5 m x 5 m MS cage. Operational cost of Rs. 5000/- per crop of carp fingerlings and Rs. 1, 67, 000/- per crop of *P. sutchi* table fish production would be required.

### Benefits

Rs. 10, 000/- per crop of fish seed from a single cage and Rs. 2, 20, 500/- per crop of *P. sutchi* table fish.



### Source

The Director, ICAR-Central Inland Fisheries Research Institute, Barrackpore, Kolkata-700120, West Bengal.

## CONTROLLED BREEDING AND SEED PRODUCTION OF PENGBA (*Osteobrama belangeri*): AN ENDANGERED FISH

Pengba is 'State Fish' of Manipur and the same is not available in any other North Eastern States. The fish fetches very high price ranging from Rs. 300-400/- per kg. It is placed under endangered category. The fingerlings of pengba were collected from Manipur and brood fish were raised at CIFE. The matured Pengba were successfully bred using 'Ovatide' and 'Ovaprim' spawning agents. The females and males were simultaneously injected @ 0.30 -0.40 ml and 0.20-0.30 ml per kg body weight of fish, respectively. A total of more than 10 lakh spawn were produced at CIFE, Mumbai, CIFE Regional Centre, Kakinada and CIFE Regional Centre, Pawarkheda. Out of these, more than 4, 00,000 fry and 50,000 fingerlings were supplied to the farmers of Andhra Pradesh for grow out trials. Some of the stock is maintained at CIFE, Mumbai and its Regional Centers for undertaking breeding and seed production programmes regularly.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

Contact to the Director of the Institute\*.

### Benefits

As the vast stretch of agriculture land became saline and unfit for any agricultural activity, the farmers can undertake *L. vannamei* culture for 100-120 days like any other agriculture crop and reap an enormous profit. This also provides desired quantity of quality seeds to the farmers and helps in getting better income to the growers due to its high value.



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## RAISING OF FISH SEED IN CAGES

For optimum fish production from reservoirs, lakes, ponds, bheels etc., it is necessary to stock them with healthy fingerlings of above 100 mm size. Thus, cage culture offers *in situ* rearing of fry to fingerling before releasing them into the reservoirs and becomes the best option available for enhancement of fish production from large water bodies. Cages are made of HDPE (high density polyethylene) with mesh size of 6 to 8 mm and cage size of 3 m × 3 m × 3 m are ideal for large and deeper open water bodies. The frame of the cage (1.5 to 2.0 ft) can be constructed from bamboo, teak or sal wood (preferably water resistant and light wood). Nutbolts or other fasteners used to construct the cage should be of rust resistant material. Framework is also provided with HDPE barrels functioning as floats. Anchors and sinkers are also used with the cages. Stocking of fish is done with fry of length, 35 mm at a stocking density of 50-200 fry/m<sup>3</sup>.

### Scope

By regularly stocking open water bodies like lakes and reservoirs with desired varieties of fingerlings and thereby improving fish catch from these water bodies.

### Cost

Contact to the Director of the Institute\*.

### Benefits

Fish farmers, fishers, co-operative societies, community depending on the reservoir fishery or other open water bodies will be benefited through generation of income and livelihood by the application of this technology.



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

# CATFISH HATCHERY TECHNOLOGY AND REARING OF SEED UNDER THREE TIER SYSTEM

35

Catfish seed production is essential for species diversification in freshwater aquaculture. The main aim of the catfish hatchery unit is to increase the survival percentage of eggs to spawn, spawn to fry and fry to fingerling stage more than 70%. The indoor catfish hatchery has three tier rearing units, such as, breeding unit, hatching unit and rearing unit. Breeding unit (tanks, size- 3 x 1 x 1 m<sup>3</sup>, fixed or portable) consists of an overhead water tank, filter unit, pump, cooling tower, oxygenation tanks. In breeding unit, five sets of brooders are released in the ratio of 1:1. In hatchery unit (fixed or portable), hatchery tubs with cemented platform (10 m x 1 m) are arranged parallel to each other. Water supply is provided from overhead tanks through common G. I. pipe and is controlled by individual valve. About 3000 eggs can be placed in each tub normally with more than 90% survival (Singhi and Magur) at water temperature of 27 ± 1°C. Rearing unit consists of three tier system. First tier consists of 6 cemented circular tanks (1 m x 1 m x 0.75 m) with flow through system. Under first tier system, spawn can be stocked @ 3000 numbers/ cistern. The hatchlings are reared in this unit @ 1000 numbers/liter of water. Proper water flow of 1-1.5/ minute and water depth of 6 cm is maintained. Second tier system consists of 12 cemented/fiber glass circular tanks (2 m x 1 m x 0.75 m) in which spawns are reared for one week. The stocking density of spawn is 300 numbers/liter of water. Under third tier system, 24 cemented circular tanks are used for rearing the fry. Continuous water flow is maintained. Soil tiles are provided for shelter. Stocking rate of fry is 25-50 numbers/ liter. Rearing of fry to fingerlings: After 15 days, fry are reared in specially prepared cement tanks with black soil base of 3-4 inch and a water level of 15 to 20 cm. Plankton, artificial fish feed or prawn powder along with soybean cake is given during the rearing period.

## Scope

This hatchery is simple in design, low cost and can be fabricated in rural areas of Andaman & Nicobar and West Bengal. The hatchery can be adopted by small and marginal entrepreneurs. The technology is simple, economic, farmer friendly and can be adopted by rural youth and women entrepreneurs to generate self-employment.

## Cost

Contact to the Director of the Institute\*.

## Benefit

Water requirement is very less as compared to other fresh water fishes in terms of hatchery operation and grow out culture.



## Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## PEN CULTURE FOR TABLE SIZE FISH PRODUCTION

Pen culture of fishes involves holding fishes as captive stock within an enclosed space made up of split bamboo/ HDPE net supported bamboo poles under human management for short or long duration. The HDPE net pen will last for 3 years. Circular pen with recommended area for a single pen unit is 0.5- 1.0 ha. Advanced fingerling of Indian major carps and exotic carps (120-150 mm) stocked in pens for raising them to table fish. Depending upon trophic status of ecosystem the suggested stocking density is 10-12 thousand/ ha with suitable species ratio and no supplementary feeding. With a survival of more than 60%, the production of fish expected is 2500-3000 kg/ha in 6 months of rearing depending on the agro-climatic area and local conditions.

### Scope

Floodplain wet lands, ox-bow lakes and marginal areas of reservoirs.

### Cost

Total cost of production is Rs. 1, 42,230/- per ha.

### Benefits

The net benefit is Rs. 1, 90,290/- per ha.



### Source

The Director, ICAR-Central Inland Fisheries Research Institute, Barrackpore, Kolkata-700120, West Bengal.

## SELECTIVE BREEDING OF ROHU (*Labeo rohita*)

37

Jayanti rohu was developed through selective breeding, by selecting Rohu, *Labeo rohita* from different founder populations of North Indian rivers. Improved Jayanti rohu is the first genetically improved fish in India. It has shown improvement in the gain of 17 per cent per generation for growth trait. Dissemination of improved rohu to different parts of India is under process.

### Scope

West Bengal.

### Cost

Dissemination to farmers is presently made through multiplier units at AP, WB and to other parts of country from CIFA, Bhubaneswar because it give two to three times more profit than others in a year. For details contact Director of the Institute\*.

### Benefits

- Substantial additive genetic variance for growth.
- Negligible heterosis (hybrid vigour) for growth.
- Ranking of full sib families for growth highly consistent.
- Average 17% realized selection response per generation after six generations of selective breeding.
- Field trials and on-farm trials confirms the growth potential of improved Rohu “Jayanti”.
- At least 20% economic gain in farmers’ ponds.
- About 31% higher survival in resistant Rohu over susceptible against aeromoniasis in F1 generation.

### Users/ Entrepreneurs/ Manufactures

M/s Sairam Hatcheries, Arkaveda, Andhra Pradesh.



### Source

\*The Director, ICAR-Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-751002, India. Tel: 916742465421/ 2465446, Fax: 916742465407. E-mail: director.cifa@icar.gov.in. Web: <http://www.cifa.nic.in>.

## INTEGRATED FISH FARMING: PIG-CUM-FISH CULTURE

Utilization of pond productivity to the maximum extent (production of fish and irrigation of nutrient rich water to agricultural crops) is the basis of integrated farming. It can play a significant role in increasing the employment opportunities, nutrition and income of rural populations. Animal wastes are considered as the most valuable soil organic resource which stimulates the growth and development of zooplankton populations-an obvious source for fish growth.

### Scope

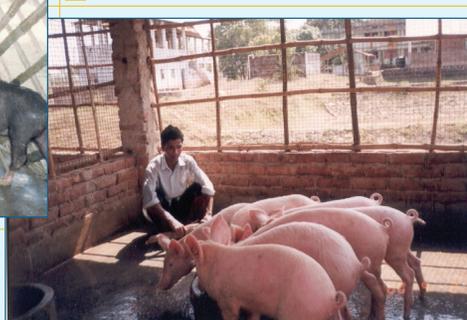
This is ideal for rain-fed farming areas where pond water remain 4-5 months for fish culture.

### Cost

Taking an average village pond as one acre in area, the variable cost and return functions of the system have been worked out for a 0.4 ha (1 acre) pond. This farming assures 68% net return on variable cost.

### Benefits

- The pig dung acts as a substitute to pond fertilizer and supplementary fish feed, reduces the cost (60%) of fish production.
- No additional land is required for piggery operation.
- Pond provides much needed water for washing the pig-sties and pigs.
- It results in high production of animal protein per unit area.
- It ensures high profit through less investment.
- The pond muck accumulated at the pond bottom due to constant application of pig dung, can be used as fertilizer for growing vegetables and other crops.



### Source

The Head, Department of Aquaculture, Faculty of Fishery Sciences, WBUAFS, Chakgaria, Kolkata-700094.

## INTEGRATED FISH FARMING: DUCK-CUM-FISH CULTURE

Under this system, duck droppings go directly into the water providing essential nutrients to increase the biomass of natural food organisms which can be utilized by fishes. The daily waste of duck feed @ 20 - 30 gm/duck serves as fish feed in ponds, resulting in higher fish yield. Ducks also serve as bio-aerators as they swim, play and chase in the pond.

### Scope

This is suitable for rain-fed farming areas where pond water remain 4-5 months for fish culture

### Cost

Taking an average village pond as one acre in area, the variable cost and return functions of the system have been worked out for a 0.4 ha (1 acre) pond. This farming assures 50% net return on variable cost.

### Benefits

- Fish utilizes the feed spilled by ducks and eat their droppings.
- Complete saving on pond fertilizers and supplementary feed.
- Ducks loosen the pond bottom with their dabbling and help to increase the pond productivity.
- Ducks get 50-75% of their total food requirement from the pond in the form of aquatic weeds, insects, molluscs etc. which do not form the food of the fish.
- Major quantities of droppings are spread by the ducks themselves over the whole pond area. This is an efficient and labour saving method of pond manuring. The ducks thus act as living manuring machines.
- No additional land is required for duckery activities.
- It ensures high profit through less investment.



### Source

The Head, Department of Aquaculture, Faculty of Fishery Sciences, WBUAFS, Chakgaria, Kolkata-700094.

## MASS CULTURE TECHNOLOGY OF FRESHWATER ALGAE (*Chlorella sp.*) AND ROTIFER (*Brachionus calyciflorus*)

Live food is essential for first feeding larvae of fish and prawn. These are key to successful seed production of many fish species like magur, koi, fresh water prawn. Rotifers are valuable live food for the culture of the larvae of most fish species. The present technology involves mass culture of *Brachionus calyciflorus* along with the pure culture of freshwater algae *Chlorella sp.* which serves as the live food for them. *Chlorella* is cultured for the continuous mass production of moina and rotifers using Bold's Basal Medium (BBM) and BG-II medium in batch culture system till they reach a density 6-10 million cells per ml. The mass culture of *B. calyciflorus* is done by the continuous culture method in rectangular cement tanks having capacity 400 liters feeding with *Chlorella* water and dried baker's yeast. Culture water is fertilized with a medium containing ammonium sulphate 100g/1000l, Single super phosphate 10g/1000l and urea 10g/1000l.

### Scope

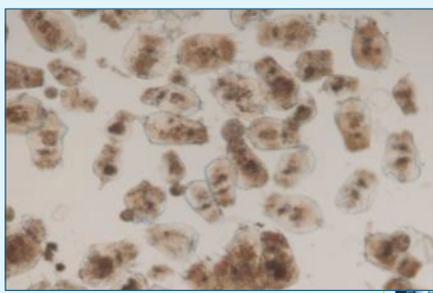
West Bengal, Andaman and Nicobar Islands.

### Cost

Contact to the Director of the Institute\*.

### Benefits

Farmers will be able to enhance the survival rate of seed of those fishes whose larval rearing is difficult due nutritional deficiencies during their first feeding stages. Farmers will immensely be benefitted while producing ornamental fish and seed production of fish species like Koi (*Anabas testudineus*) and Magur (*Clarias batrachus*).



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

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The Scientist-In-Charge, ICAR-Central Institute of Fisheries Education (Deemed University), Kolkata Centre, 32-GN Block, Sector-V, Salt Lake City, Kolkata-700091, Tel: 033-23573893/7265/5269, Fax: 033-23573469, Website: [www.cife.edu.in](http://www.cife.edu.in).

# NUTRIENT DENSE MICRO PARTICULATE DIET

41

Appropriate feed is essential for proper larval development of *Macrobrachium sp.* CIFE has developed a nutrient dense nutraceutical based microparticulate diet with protein hydrolysate. The larval diet has a particle size ranging from 18 to 50  $\mu\text{m}$ .

## Scope

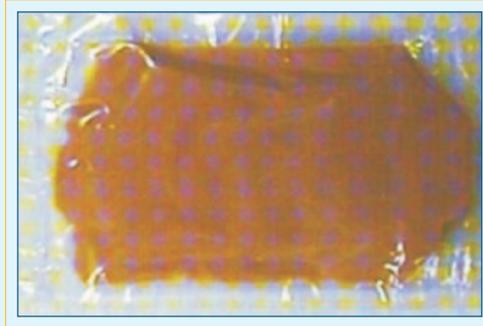
This larval feed has wide application in prawn hatcheries of West Bengal and Andaman & Nicobar Islands.

## Cost

Contact to the Director of the Institute\*.

## Benefit

This diet can replace *Artemia nauplii* as larval feed up to 40%. This will help in reduction of dependence on *Artemia nauplii* thereby reducing the cost of production in turn.



## Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## FRP MAGUR HATCHERY

Magur is a high priced and well preferred catfish marketed in live condition. It has tremendous potential as a diversified catfish in increasing fish production from its aquaculture.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

- Total investment for 1 ha water area is Rs. 2.5 lakhs.
- Rate of return from 1 ha water area is Rs. 0.8 lakhs.

### Benefits

- Cultured in any water body.
- High nutrition and therapeutic value.
- Sold in live condition.

### Users/ Entrepreneurs/ Manufactures

M/s Durga enterprises, Bhubaneswar.



### Source

The Director, ICAR-Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-751002, India. Tel: 916742465421/ 2465446, Fax: 916742465407. E-mail: director.cifa@icar.gov.in. Web: <http://www.cifa.nic.in>.

## DIESEL OPERATED NEW AERATION DEVICE FOR LARGE AQUACULTURE PONDS

It is an aeration device for large aquaculture pond which increases the dissolved oxygen (DO) level of the water approximately double in 2 hr. Dissolved oxygen is the single most important factor governing survival and growth of fish in the intensive and semi intensive culture systems. Feed intake and growth of fish is adversely affected when dissolved oxygen (DO) level becomes low. If DO levels remain low for prolonged periods, fish become susceptible to disease and entire stocks in the pond may be lost due to lack of oxygen. Therefore, aeration becomes necessary to supplement natural sources of dissolved oxygen in ponds stocked at higher stocking densities. After aeration-

- It restores oxygen level which improve fish habitat through constant oxygen cycle.
- The air induced circulation which help ton removes toxic gases from the bottom water.
- Circulated oxygen enhances benthic organism and fish to leave in bottom.
- Fish are become healthier by getting natural food, abundant oxygen, lack of toxin, lack of diseases organism.
- Proper recycling of energy in between the organism of different level of water, through the process of food-chain results maintaining a healthier ecosystem.

### Scope

West Bengal and Andaman & Nicobar Islands.

### Cost

Contact to the Director of the Institute\*.

### Benefits

- In the countryside, where fish farms are mostly located, the electric supply is either nonexistent or highly uncertain. Keeping in mind the erratic power supply, a diesel operated aerator has been developed.
- Since, it is a mobile aerator, by using an indigenously made bottom racker, it can rack/ disturb the bottom and releases many obnoxious gas deposited in the pond bottom during the culture period.
- Indigenous made.
- Easy maintenance.
- Easy to operate.
- Aeration, bottom racking and multi utility device.
- Enhances oxygen within 2 hours to the tune of almost double.



### Source

\* The Director, ICAR-Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-751002, India. Tel: 916742465421/ 2465446, Fax: 916742465407. E-mail: director.cifa@icar.gov.in. Web: <http://www.cifa.nic.in>.



Remember, your work may be only to sweep a railway crossing, but it is your duty to keep it so clean that no other crossing in the world is as clean as yours.

- M Visvesvaraya

## PORTABLE FRP CARP HATCHERY

The system operates with the principle of eco-hatchery. One complete unit consists of the following components-

- Breeding/ spawning pool (2.15 m diameter, 0.9 m height, 1:22 bottom slope and 3409 litres total capacity with operation capacity 2950 litres).
- Hatching/ incubation pool (1.4 m diameter, 0.98 m height, 1,400 lit. total volume and 1,200 litres net egg incubation volume with a FRP inner chamber of 0.4 m diameter and 90 cm height covered with nylon bolting cloth to filter the excess water to the drain).
- Egg/ spawn collection chamber (size of 1.0 × 0.5 × 0.5 m with water holding capacity 250 litres).
- Overhead storage tank/ water supply lines. The technology was commercialized on 21<sup>st</sup> June 2006. It was released to the nation by His Excellency the Governor of Odisha, Shri Rameshwar Thakur on 14th July 2006 at CIFA, Bhubaneswar.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

The cost of one unit (excluding overhead tank) is around Rs. 1 lakh. Net income from the hatchery operation in one monsoon season (20 cycles of operation) is Rs. 44, 500/-.

### Benefits

- Easy transportation to different locations.
- Easy to install and operate.
- Requires less space (6.0 x 3.0m) for installation and can even be placed on a pond dyke.
- Easy to repair and replace minor fittings. It is suitable for small scale breeding with production capacity of 1.0-1.2 million spawn of Asiatic carps in one operation. Its efficiency is above 85%. The unit can be operated by unemployed youth, Gram panchayat and Cooperative Society on self-operational / rental basis. Hence, it can be used as tool for employment generation, enhancing the fish pond productivity and livelihood of farmers.

### Users/ Entrepreneurs/ Manufactures

M/s M. R. Aqua Tech, Bhubaneswar, Odisha.



### Source

The Director, ICAR-Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-751002, India. Tel: 916742465421/ 2465446, Fax: 916742465407. E-mail: director.cifa@icar.gov.in. Web: <http://www.cifa.nic.in>.

## FRP DEMAND FISH FEEDER

Supplementary feeding is the major input in semi-intensive or intensive aquaculture practices as naturally available food is not sufficient to support the fish biomass. Supply of good quality feed and maintaining the suitable culture environment are important principles in aquaculture. Application of feed through feeder is an important technological intervention in improving efficiency of feed delivery to fish. AICRP on APA, CIFA Centre has designed demand and automatic feeders which are tested for carp feeding in Indian condition. Among them, the self-demand feeders appear to be more suitable in Indian conditions. FRP demand fish feeder has main components of 30 liter capacity feed hopper and activated mechanism. The feeder is installed in a pond with the activating mechanism extending into the water through an activator rod. The activating mechanism includes steel bait rod, feed platform, feed protecting cover and pendulum or feeding tray in case of sinking feed. The feed drops by gravity onto the adjustable acrylic feed platform positioned below the hopper and above the water level. When fish activates the rod, feed pellets retained on the feed platform slowly drop on to the water surface. The gap (distance) between the feed platform and the end of the hopper cone is adjusted as per the size of the pellet feed.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

The cost of saving from implementation of the technology was calculated to be Rs. 26,710/- per hectare of culture pond. The number of demand fish feeders needed is 15 per hectare. The fabrication cost of a feeder of 10 kg feed holding capacity with tripod GI stand is about Rs. 10,100/-.

### Benefits

- It is easy to construct, low cost and maintenance free.
- The feeder is suitable for pelleted feed and can be used in any kind of rearing system.
- The growth rates of fish were estimated 10-15% higher in the demand feeding cisterns / tanks fitted with feeders than the hand feeding tanks.
- The demand feeders will increase feed consumption in fish by making it available to them continuously.
- The designed feeder can hold 10 kg feed, which is sufficient to feed 500 kg fish if fed @ 2% of their body weight per day.
- By reducing the feed quantity to the pond, the organic pollution will be less in the feeder fitted pond.



### Source

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# MECHANICAL POND APPLICATOR

Management of large aquaculture pond environment always has the limitation for uniform application of the inputs due to inaccessibility from dyke to the central areas. Use of floating rafts or boats help in such ponds for taking the inputs to the central portion. However, such practice is always cumbersome and labour intensive. This necessitated development of the mechanical pond applicator (MPA) that would mechanically spread the inputs uniformly in the pond and effectively reduces the manpower requirement for the culture operation.

## Scope

Andaman & Nicobar Islands and West Bengal.

## Cost

The cost is approximately Rs. 65,000/- excluding the pump.

## Benefits

- Ease the culture operation in large ponds. Effective reduction of manpower for aquaculture operation (only one man is managing entire intensive grow-out culture operation in a 4 ha pond since last three years in CIFA).
- Uniform distribution of inputs such as cow dung, poultry manure, lime, inorganic fertilizers and medicines using mechanical spraying.
- Cost efficient input application (using the MPA, one labour can apply 800 kg lime uniformly in a 4 ha pond in six hours. The pump consumes 0.5 litres/ hour kerosene).
- Raft can also be used to provide feed in the feeding bags/ platforms.



## Source

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## STARTER-M

Starter-M is nutritionally balanced and highly palatable for baby magur. It ensures faster growth and high larval survival. Fourteen days feeding of Starter-M is good enough to get healthy fry. It is very much stable in aquatic environment. Ordinary dry and cool place is suitable to store feed packets.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

Expected costs for this technology is Rs. 10.0 lakh.

### Benefits

- Feeding of Starter-M ensures complete availability balanced nutrients to the magur larvae, just after their yolk sac absorption.
- Dependence on uncertain natural foods is minimized.
- Starter-M ensures availability of healthy fry with more than 90% larval survival, under good hatchery management practices. Ensures seed availability for magur culture.



### Source

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CIFA for the first time in India has developed a balanced feed for carp brood after a decade of research duly validated through repeated field trials. This ensures quality and quantity of egg production, remarkable improvement in their breeding responses and hatching performance. The feed was tested first in the Institute's pond of carp breeding unit at CIFA farm during 1996-98. Later, it was again tested in KVK pond of CIFA in 1998. The feed was also tested in off season gonad maturation and breeding experiment of CIFA in controlled condition during 2007-2009. The feed is tested (July-September, 2012) in farmers' (Asha Fish Breeding Farm) pond at Ramsagar, Bishnupur, Bankura, W.B.

## Scope

Andaman & Nicobar Islands and West Bengal.

## Cost

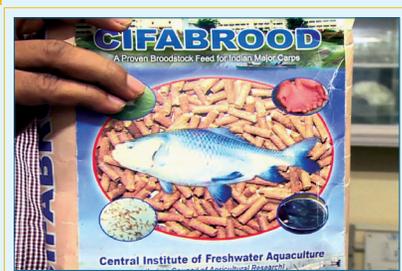
- Tentative cost per kg of feed is Rs. 85/-.
- Rate of feeding brood carps 3-5% of total body weight of fish during vitellogenic phases 2% of the total body weight during post-vitellogenic phase.

## Benefits

- Readily accepted by carp broods, palatable and water stable.
- Adequately nutrient rich, provides essential nutrients generally lacking in conventional feed or natural fish organisms.
- Advances gonad growth and maturation and facilitates early spawning.
- Improves breeding response.
- Ensures higher production of viable eggs and sperms.
- Remarkably improves hatching performance.
- Suitable for multiple/repeated breeding in carp.
- Enhances spent fish recovery.
- Promises higher recovery of quality seed per unit body weight of female.
- Ensures better survival of seed and rapid growth during nursery rearing.
- Economically viable and validated through repeated field trial.

## Users/ Entrepreneurs/ Manufactures

M/s Aisharya Aquaculture Pvt. Ltd. Naihati, West Bengal.



## Source

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## ANTI-STRESS FORMULATION FOR FISH SEED TRANSPORT: CIFELOSTRESS

As fish seed stocked by farmers is frequently handled before reaching the stocking pond, it is important to maintain the fish seed quality by reducing the stress. Transportation and related stress are the key factors which contribute to the low quality of fish seed. CIFE, Mumbai has developed an anti-stress formulation for fish seed transportation. CIFELOSTRESS, the anti-stress formulation contains sedatives, buffers and electrolytes. The product helps to reduce transportation costs for fish seed by packing 1.5 times more seed. It helps to reduce mortality during and post transport.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

Contact to the Director of the Institute\*.

### Benefit

Farmers and fish transporter will be benefited by application of this product while transporting fish seed.

### Users/ Entrepreneurs/ Manufactures

Technology has been transferred to Aqua Vet Laboratory, Ranchi.



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## ANTI-STRESS HERBAL FORMULATION FOR LIVE FISH/ SHELLFISH: CIFE CALM

To overcome the peculiar constraint and facilitate proper handling of fish, CIFE has developed an anti-stress herbal formulation for live fish/ shellfish. The formulation is an alcoholic extracts of *Ugenia caryophyllata* and *Mentha arvensis* at appropriate concentration. Generally, 2 drops or 50 µl of CIFE CALM per liter of water is required to tranquilize a fish. However, the dosages may vary according to size and species of fish/ shellfish.

### Scope

The product helps in tranquilization of fish and shellfish for laboratory purpose.

### Cost

Contact to the Director of the Institute\*.

### Benefit

To keep the fish in stable calm condition for collection of blood sample, taking length-weight data, and vaccinating fishes.



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## CIFAX

It is a chemical formulation for fish against parasitic & bacterial diseases. It prevents and cures ulcerative diseases of fresh water fishes. It is also a control measure for parasitic and bacterial infections. This is very effective against epizootic ulcerative syndrome (EUS). CIFAX is one the commercialized technology of CIFA.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

Expected costs for this technology is Rs. 41,01,111/- .

### Benefit

It is applicable in pond & hatcheries conditions to fight against epizootic ulcerative syndrome and other bacterial/parasitic diseases.

### Users/ Entrepreneurs/ Manufactures

M/s Durga Enterprises, Bhubaneswar, Odisha.



### Source

The Director, ICAR-Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-751002, India. Tel: 916742465421/ 2465446, Fax: 916742465407. E-mail: director.cifa@icar.gov.in. Web: <http://www.cifa.nic.in>.

In India, many laboratories (including CIFA) are working to protect carps and catfishes against diseases. The majority of the objectives of those studies are to develop effective treatment / measures against epizootic ulcerative syndrome (EUS), Aeromoniasis caused by *A. hydrophila*, Edwardsiellosis by *E. tarda* and white spot syndrome in prawn caused by white spot syndrome virus (WSSV).

## Scope

Andaman & Nicobar Islands and West Bengal.

## Cost

Expected production cost for this technology is Rs. 2,05,000/.

## Benefit

It controls bacterial and fungal infections like hemorrhagic, septicemia, ulcers, fin rot, eye disease, mouth fungus etc. in ornamental fishes.

## Users/ Entrepreneurs/ Manufactures

M/s Durga Enterprises, Bhubaneswar, Odisha.



## Source

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## DOT-ELISA KIT

'Dot-ELISA Kit' is used for diagnosis of Edwardsiellosis, Aeromoniasis and bacterial gill disease of carps. It is a development of newer immunodiagnosics against important diseases of fish and shellfish.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

The production cost ranges up-to Rs. 2000/- per kit, where 100 samples can be diagnosed at a time.

### Benefit

It detects the bacterial antigen in infected tissues up-to 72 hours of death and antibodies in serum for routine health monitoring of fish stock. It is suitable for farm site and laboratory use as well as health certification by diagnostic laboratories.



### Source

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# IMMUNOBOOST-C

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IMMUNOBOOST-C is an immune-stimulant to improve brood fish health and seed production in carps. It modulates the fish immunity against microbial diseases and has been proven through extensive trials conducted at many aquaculture regions in India.

## Scope

Andaman & Nicobar Islands and West Bengal.

## Cost

Expected costs for this technology is Rs. 3, 00, 000/-.

## Benefits

- IMMUNOBOOST-C @ 0.2ml / kg body weight if injected to brood fish before 15 days of breeding enhances immunity levels and disease resistance of brood fish itself and spawn thereby more seed production.
- IMMUNOBOOST-C upon injection to brood fish at the above dose before winter enhances the disease resistance.
- It is also given to spawn, fry and fingerlings through bath treatment during seed transport.

## Users/ Entrepreneurs/ Manufactures

M/s Smruti Agency, Plot No. 522, Gadasrirampur, Bhubaneswar, Odisha.



## Source

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## A PCR BASED ROHU CATLA HYBRID DETECTION KIT

A PCR based identification kit has been developed which can identify in a hybrid in just two steps with genomic DNA as starting material. This is a specific kit designed for the identification of *Labeo rohita* (rohu), *Catla catla* (catla) and their hybrid in the early life stages. This technology would really be of great use for those producers and buyers for screening of quality seeds and moreover it would be a stepping stone for seed certification programs for both government and private hatcheries. This technology will be of great use in the seed certification program and also will be beneficial to the farmers for quality and pure seed culture.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

Contact to the Director of the Institute\*.

### Benefits

- Highly specific for Rohu, Catla hybrids in reciprocal crosses.
- Ensure purity of seed.
- Potential for seed certification.
- No sequencing is required.
- Detection can be done easily in an agarose gel.
- Less time consuming process, 4-6 hours.



### Source

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# SPOT AGGLUTINATION KIT

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Spot agglutination kit is an on farm diagnostic test which detects disease - Vibriosis, the major bacterial disease of fish in few seconds.

## Scope

Andaman & Nicobar Islands and West Bengal.

## Cost

The production cost ranges up-to Rs. 500/- per kit, where 50-60 samples can be diagnosed using one kit.

## Benefits

- Fast method for disease detection.
- 30-40 samples can be tested within an hour.
- Easy to be used by common fish farmers.
- Need no sophistication.
- Suitable for farm level diagnosis.



## Source

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## WHITE TAIL DISEASE DIAGNOSTIC KIT

White tail disease (WTD) or white muscle disease (WMD) has caused mass mortality in larval and early juvenile stages as well as devastating production loss in culture systems of *Macrobrachium rosenbergii* (scampi) in many countries, particularly India, China, Thailand and Taiwan. Recently, it has been reported from Australia also.

### Scope

West Bengal.

### Cost

A single sample screening would cost around Rs. 1000/-. However, the cost can be substantially reduced depending upon the screening sample size the kit contains for.

### Benefits

- It is caused by a single-positive stranded bisegmented RNA virus (~ 4.2 kb size), being named as *M. rosenbergii* nodavirus (*MrNV*), belonging to Nodaviridae family.
- It is mostly associated with another extra small virus-like particle (XSV), which is acting as satellite virus. It is now evident that infected broods or seeds are the common source of *MrNV* infection in the hatchery or nursery or rearing ponds. Hence, PCR screening of broods or seeds can significantly reduce the risk of crop failure.
- Conventional diagnostics fail to detect early stages of infection. CIFA has made a breakthrough in developing a genome based detection system of this *Macrobrachium rosenbergii* nodavirus, the causative agent of WTD.
- This kit, based on nested PCR method for RNA segment II, is a sensitive and specific diagnostic tool that can detect carriers and early or latent infections.
- Detects up to four virus particles.
- Follows nested PCR principles – high sensitivity & specificity of virus detection.
- The entire procedure can be completed within a day.



### Source

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## LONG-HAIRPIN RNA EXPRESSING PLASMID VACCINE TO CONTROL WSSV IN *Penaeus monodon*

ICAR-Central Institute of Fisheries Education has recently designed and constructed a DNA vaccine (pCMVvp28- LH) to protect tiger shrimp, *Penaeus monodon* against WSSV. When administered by dip treatment or injection, the plasmid construct is capable of expressing a long hairpin RNA (lh-RNA) molecule that can trigger an RNA interference response against the target transcript *vp28* that encodes an antigenic envelop protein. A single injection administered intra-muscularly ensured the distribution of the construct to all parts of the shrimp body, as the construct could be PCR amplified from several tissues when tested 2 days after administration. The ability of the lh-RNA to knockdown the expression of the target transcript was confirmed in human fibroblast cell lines by co transfecting the vaccine construct with a full length expression construct of *vp28* gene was 81% less than controls, which observation can also be related to the lower virus copy number. It was concluded that this knockdown was the major mechanism of protection.

### Scope

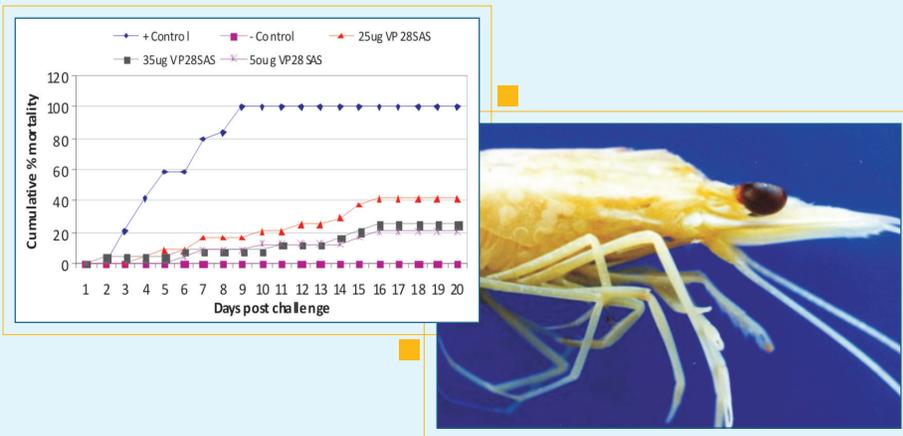
The recent dip treatment experiments have shown efficient uptake of the chitosan-DNA nano-particles by post larvae. This method is most simple and easily applicable just before stocking in grow-out ponds.

### Cost

Contact to the Director of the Institute\*.

### Benefit

Using freshwater prawn, *Macrobrachium rosenbergii* as a model organism it has also been shown that when immature and mature females (eggs-on-head) and mature males are injected with the vaccine, it passes on to the offspring. Although, this has not been tested in *P. monodon*, it is very likely that this can be an ideal and simple way of protecting brooders and young larvae.



### Source

The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## IMMUNODIAGNOSTIC KIT FOR WHITE TAIL DISEASE OF GIANT FRESHWATER PRAWN

Whitetail disease (WTD) is an acute viral disease of *Macrobrachium rosenbergii* affecting the post-larval and early juvenile stages causing up to 100% mortality resulting huge loss to farmers. The disease is caused by two RNA viruses, *M. rosenbergii* nodavirus (MrNV) and a satellite virus, extra small virus (XSV). The technology is based on detecting white tail disease affected *M. rosenbergii* post-larvae by immunodot assay using monoclonal antibodies. Monoclonal antibodies have been produced against the recombinant capsid protein of XSV. The test involves homogenization of the infected (suspected) post larvae and blotting 2  $\mu$ l of the clarified homogenate on a nitrocellulose membrane. The membrane is air-dried and blocked with blocking agents. The membrane is then incubated with the monoclonal antibodies for 1 hour. Subsequently, the membrane is washed and incubated with anti-mouse HRP conjugate. The membrane is washed and incubated with substrate solution. Positive samples produce a brown precipitate.

### Scope

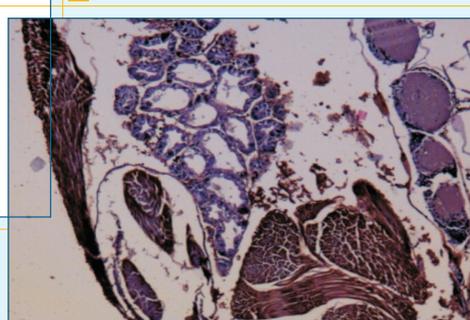
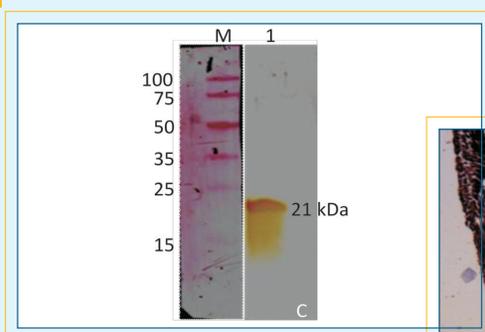
Currently, the market potential of the technology is limited due to the fact that *M. rosenbergii* culture has come down markedly in recent times due to frequent disease outbreaks.

### Cost

Contact to the Director of the Institute\*.

### Benefit

The test does not require sophisticated equipment or skilled technician. The test can be performed at hatchery and farm level. The reagents can be packed in the form of a kit. Early detection of the disease will help in minimizing the loss to the hatchery and farmers by isolating the infected stock from the healthy ones.



### Source

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Maintenance of quality of fish seed is mainly dependent on good brood husbandry, stock exchange and brood stock replenishment at regular interval. Recently, poor growth of hatchery bred seed has been a real concern in fish farming communities. This occurs due to mating of closely related individuals primarily through breeding the same stock over many generations. To improve the quality of stock, a useful strategy may be to cryopreserve the milt of better fish stock and use in different hatcheries of India. Cryopreserved semen can be used to maintain genetic diversity of fish populations and protect against inbreeding. For doing this, a low cost handy cryo-freezer, named CIFA-CRYO, was developed and commercialized for public use in the year 2010.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

Expected costs for this technology is Rs. 2,50,000/-

### Benefits

- CIFA-CRYO is a manually operated handy cryofreezer for gamete cryopreservation of fishes. This is better suitable and more advantageous in terms of liquid nitrogen use, size of the unit, on-farm utilization and easy operation.
- A hypertonic, physiological medium removes most of the water from cells before they freeze. If such dehydration doesn't occur, large intracellular crystals of ice is formed which damage cells severely.
- Cryo-protectants prevent the ice crystallization in the cells and protect the intact physiological status under cryogenic conditions. Thus, the carp milt can be preserved for years together in a suitable medium under cryogenic conditions (-196° C) using CIFA-CRYO. In this machine desired cooling rates can be achieved by increasing the water temperature of the lower chamber.

### Users/ Entrepreneurs/ Manufactures

M/s Biotechnika, Bhubaneswar, Odisha.



### Source

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## OPTIMIZATION OF SPERMATOZOA REQUIREMENT FOR ARTIFICIAL INSEMINATION IN CARP

The technique is employed for the efficient use of carp spermatozoa to fertilize the eggs. Milt is preserved at ultra-low temperatures (-196 °C). The ratio of sperms and egg should be 10000:1 for effective fertilization. The results of this experiment have been published in the *Indian Journal of Fisheries* and are being used for maximum use of male brooders.

### Scope

The technology has wide scope of application in Andaman & Nicobar Islands and West Bengal.

### Cost

Contact to the Director of the Institute\*.

### Benefit

- The technique is extremely useful for optimum utilization of milt procured from selected brooders of carps and getting effective fertilization.

### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).



If there has been any success in my life, that was built on the unshakable foundation of failure...

- A J C Bose

The technology helps in preserving the milt of male individuals of high genetic worth for stock improvement. Progeny thus produced is of outstanding potential as for as major economic traits are concerned. CIFE, Mumbai has developed the techniques for the short term preservation of catfish (*Clarias batrachus*) milt. The milt was collected from potential male brooders, diluted with extenders and added with cryo-protectants. Milt was further filled in straws, preserved in vapors of liquid nitrogen and further immersed in the liquid. The milt was found to be potential to fertilize the eggs, although the percentage of fertilization was about 20%.

### Scope

The technology has wide scope of application in Andaman & Nicobar and West Bengal for production of fishes throughout the year.

### Cost

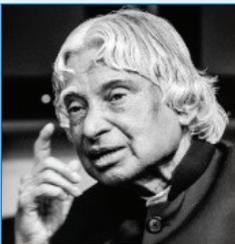
Contact to the Director of the Institute\*.

### Benefit

This technique is useful for production of rare species by preserving sperms. Gradually, the exotic species are grabbing market, but, by this process, our native fish species can also survive and conserved where female maturation time and male maturation time vary, through by this technique we can do fertilization without any difficulties.

### Source

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Failure will never overtake me if my determination to succeed is strong enough.

- A P J Abdul Kalam

## ORGANIC AQUACULTURE THROUGH BIO-FERTILIZERS

The use of non-biodegradable fertilizers and pesticides in aquaculture causes health hazards in fishes including environmental degradation due to the presence of toxic materials. ICAR-CIFE, Mumbai is involved in developing and disseminating technology that controls the environmental problems and health hazards of aquatic organisms and helps in ensuring the human health through production of commercially important aquatic organisms on sustainable basis in eco-friendly manner. Bio-fertilizers help in maintaining ecological environment. Organic produce fetches good market value due to increasing demand globally. Nitrogen-fixing bacteria *Azetobacter chroococcum* and phosphatase producing bacteria, *Bacillus sp.* were carried out separately in a large scale. Its shelf-life was over three months. This can be applied at the interval of 15 days in freshwater carp culture ponds. Required density  $10^9$  c.f.u./ ml. broth culture of these bacteria were inoculated in sterilized and moist charcoal at room temperature to get  $10^6 - 10^9$  c.f.u./g of charcoal.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

Contact to the Director of the Institute\*.

### Benefit

It helps in maintaining good health of public. It will also help in earning foreign exchange. Nitrogen and phosphorus are provided in aquaculture system from external sources in the form of organic manures and inorganic fertilizers which play a very important role in primary production.

### Source

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Build a strong base. The journey to peaks of excellence requires a strong base camp.

- C N R Rao

## SAFE AND EFFECTIVE CHEMICAL CONTROL FOR FLOATING AQUATIC WEED WATER HYACINTH (*Eichhornia crassipes* L.)

Weed infestation in water bodies is a serious problem in fisheries. It destabilizes the balance of the ecosystem and the basic source of livelihood of the fish farmers. Floating weeds like water hyacinth can cover the whole water body within few months when allowed to grow without any interventions. Fish worth millions of rupees are lost every year at the hand of this weed menace. Different herbicides e.g. 2,4-D Na Salt, 2,4-D ester, 2,4-D amine salt, glyphosate etc. are used to control the invasive aquatic weed water hyacinth. However, in aquatic systems which are primarily used for fisheries and aquaculture, decisions of selecting the ideal herbicide and its dose for the control of this weed can vary depending upon the situation. 2,4-D ester was found to be a better choice for controlling water hyacinth (than 2,4-D salts) when there is no fish in ponds or lakes for which a dose of 2 to 5 kg/ ha produce good control. However, 2,4-D ester is toxic when there are fishes. 2,4-D Na or amine salts should be used @ 5 to 10 kg/ ha when it is desired to control the weed for fisheries and aquaculture purpose. Depending upon the growth stages of weed, the dose will vary from 5 to 10 kg/ ha. Tender stages of weed require low dosage (5 kg/ ha) to control while higher dosage is required for matured stage. Glyphosate also control this weed at 5 to 10 kg/ ha but cost of treatment with glyphosate is higher than other herbicides. In terms of effectiveness, environmental safety and cost of treatment, 2,4-D Na salt is the best option for the weed and a dose of 5 and 10 kg/ ha is to be applied to get significant control for tender and matured weeds respectively.

To get the maximum effect per unit weight of herbicide the following points should be considered.

- ⊙ Herbicide should be applied when the aquatic weeds are in tender stage.
- ⊙ Spring season is best for controlling aquatic weeds as during this time of the year, weeds were small and easier to control than during the summer, and levels of dissolved oxygen in the water were usually higher.
- ⊙ Treating a pond with herbicides during the hot summer months was found to be risky, because during this time of year, dissolved oxygen concentrations tend to be lower and weed biomass is higher.
- ⊙ Treating less than half (best one-fourth to one third) of the total water area of a pond or lake at a time with herbicide can minimize the risk of depleting dissolved oxygen and fish mortality.

### Scope

West Bengal.

### Cost

Contact to the Director of the Institute\*.

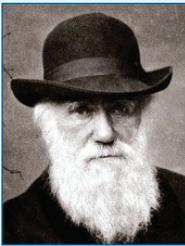
### Benefits

It will help in increasing production of fish per unit area of water body.



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).



If I had my life to live over again, I would have made a rule to read some poetry and listen to some music at least once every week.

- Charles Darwin

# CHAPTER 3

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## Ornamental Fish Culture



Basic social and economic change needs to be brought about gradually and the more carefully and thoughtfully effected, the more permanent it will be.

- Vikram Sarabhai

## BREEDING AND REARING OF AN EXOTIC ORNAMENTAL CICHLID (*Pterophyllum scalare*)

The demand of angel fish, *Pterophyllum scalare*, among the aquarists is high in India, the fry of this exotic cichlid are still have to be imported. Therefore, it is necessary to develop a body of knowledge regarding commercial breeding and rearing of this fish under Indian condition which are indispensable pre-requisite to boost up their trade. CIFE Kolkata developed the technology for the Angle breeding for mass scale seed production under captive condition. The age of brooder was optimized for sexual maturity and spawning. The hatchability of laid eggs was also improved, and the developed health and feeding management gave the fry a good survivability and improve in mass production.

### Scope

It is suitable for every agro climatic zone of India.

### Cost

With an investment of Rs. 45,000/- for 20 brooders (10 males with 10 females) unit one can easily earn an amount of Rs. 51,000/- annually.

### Benefits

- Less space requirement and less investment with high cost: benefit ratio are the main advantages of this trade. To boost up the local economy and to meet the unemployment problem, at least in part, this new vocation has scope for indoor aqua business.



### Source

The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

Or

The Scientist-In-Charge, ICAR-Central Institute of Fisheries Education (Deemed University), Kolkata Centre, 32-GN Block, Sector-V, Salt Lake City, Kolkata-700091, Tel: 033-23573893/7265/5269, Fax: 033-23573469, Website: [www.cife.edu.in](http://www.cife.edu.in).

## BREEDING AND SEED PRODUCTION OF HIGH VALUE ORNAMENTAL CAT FISH (*Corydoras aeneus*)

The Cory Cat, *Corydoras aeneus*, a native of South America, lives in fairly fast-flowing rivers is a popular ornamental fish worldwide. The main advantage of this species is that both the sexes have equal acceptance with high commercial value. The ICAR-CIFE, Kolkata has developed a body of knowledge regarding commercial breeding and rearing of this fish under Indian condition. The system for proper brooder management was developed with suitable feeding and sanitary measures in aquarium water. Commercial scale breeding system was standardized in cemented cistern. In this system, hatchling of eggs was satisfactory and fry could be maintained with good survivability rate. This technology provided a package of practices for commercial seed production of Cory Cat.

### Scope

It is suitable for every agro climatic zone of Andaman & Nicobar Islands and West Bengal.

### Cost

With a minimum investment for 150 brooders (100 males with 50 females) unit one can easily earn an amount of Rs. 35,900/- annually.

### Benefits

Less space requirement and less investment with high Cost Benefit Ratio (CBR) are the main advantages of this trade. To boost up the local economy and to meet the unemployment problem, at least in part, this new vocation has scope for indoor aqua business.



### Source

The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

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The Scientist-In-Charge, ICAR-Central Institute of Fisheries Education (Deemed University), Kolkata Centre, 32-GN Block, Sector-V, Salt Lake City, Kolkata-700091, Tel: 033-23573893/7265/5269, Fax: 033-23573469, Website: [www.cife.edu.in](http://www.cife.edu.in).

# COLOUR ENHANCEMENT OF ORNAMENTAL FISH THROUGH CAROTENOID RICH FEED

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Colour enhancement through the use of natural carotenoids in feed is one of the measures to enhance coloration and brightness of the colourful ornamental fish. Carotenoids are nitrogen free polyene pigments responsible for red, orange, yellow colors occur in hues of plant leaves, fruits, flowers, some fishes, birds, insects and crustaceans. Among the natural carotenoids sources studied, red marigold flower meal was identified as the richest sources of  $\beta$ -carotene, canthaxanthin and xanthophylls. Hence, these were incorporated in the ornamental fish feed. Carotenoids are only synthesized by plants and modified in animal tissues, fish must obtain them from their diet. It is advisable to ensure that ornamental fishes obtain a constant intake and adequate level of carotenoids in their feed. The feeds were prepared by supplementing red marigold flower meal at 4% to the control diet replacing the same amount of rice bran. The granular feed was prepared by using the spheronizer. The total carotenoid content in the fish at the start of experimental feeding trial was  $8.53 \pm 2.12 \mu\text{g/g}$  wet weight and at the end of feeding trial was  $20.59 \pm 4.11 \mu\text{g/g}$  wet weight.

## Scope

The feed additive can be used by the aquarists especially hobbyist, hatchery managers and breeders to enhance desired colour of ornamental fish to increase the marketable value. This is a proven technology for gold fish, blue gourami, swordtail and other common ornamental fish.

## Cost

Contact to the Director of the Institute\*.

## Benefit

Red marigold petal meal was found to be an effective colour enhancer at a cheaper price without any adverse effect on growth and body composition of fish.



Red marigold diet

## Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## SHINING BARB

A new variant of Rosy Barb, *Pethia conchoniis* called Shining Barb has been developed after 8 years of research through selective breeding. The pink red shining colour male and golden yellow shining female are more attractive compared to the normal rosy barb variety available in the market. The pure line shining barb has shown golden shining colour at their dorsal side in young ones after a month of rearing and after 4-5 months of rearing the sexual dimorphism develops with difference of colour with vibrant shining colour. A glittering gold colour in female and shining pink red in male is expected to fetch significantly higher price than its normal counterpart available in aquarium trade industry. The advantages are– i) unlike Rosy Barb, it can withstand a wide range of water quality for breeding and culture and ii) due to shining in nature and beautiful coloration, the demand is expected to be much higher than the normal Rosy Barb.

### Scope

West Bengal.

### Cost

Contact to the Director of the Institute\*.

### Benefits

- The shining and vibrant color of the fish attracts the hobbyists as well as traders which can fetch good price in the domestic and export market. Due to its demand, it may provide additional livelihood for the adopting farmers in the rural areas.
- The technology is released for field trial on experimental basis and the MOU is signed with the implementing farmer to pay 10% percent of the total sale proceed during the MOU period.

### Users/ Entrepreneurs/ Manufactures

Dr. Atul Kumar Jain, Director, Tropical Aquaculture and Farming Systems (India), A-104, Galaxy Apartments, Old Fatehpura, BedlaRoa, Udaipur-313001, Rajasthan.



### Source

\* The Director, ICAR-Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-751002, India. Tel: 916742465421/ 2465446, Fax: 916742465407. E-mail: director.cifa@icar.gov.in. Web: <http://www.cifa.nic.in>.

The technology can be initiated with Rs 2.5 lakhs for production of 4000-5000 seeds per year. Brooders can be collected from wild or can be selected from laboratory produced fishes. Breeding pair formation can be done in aquarium tank and each pairs will be reared in spawning tanks with one symbiotic anemone. Daily feeding with wet feeds till satiation @ 4 times a day and 2/3<sup>rd</sup> water exchange is to be done. After pair formation spawning will be occurring by 5 to 6 months period. The incubation periods of eggs will be take place from 6 to 7 days. Yolk sac absorption will be occurred within 12-48 hours based on temperature. Feeding of larvae, will be done with Rotifer @ 10-12 nos/ ml, 24 hours after hatching till 15 days and newly hatched *Artemia nauplii* @ 3-5 nos/ ml from 15 onwards. The larvae become advanced fry after 25- 30 days of rearing and shall be ready for marketing.

### Scope

There are plenty scopes to culture marine ornamental fishes in Andaman & Nicobar Islands. The reef waters of Andaman & Nicobar Islands harbours a variety of exportable and valuable ornamental fishes.

### Cost

Total cost is Rs. 4,00,000/- inclusive of capital cost of Rs. 2,50,000/- and recurring cost of Rs. 1,50,000/- (aquarium fabrication -minimum 10 numbers with 2 FRP tanks of 100 litres, high blow air blower, UV filter, glassware and water heater).

### Benefits

- The income may vary depending on the rate and market demand of ornamental fishes. Breeding minimum of 10 pairs will yield fecundity of 20000 eggs and with survival rate of minimum 50 %, 10000 fry can be produced. The market rate for per piece is approximately Rs. 50/- will give Rs. 5, 00,000/-. Profit will come Rs. 1,00,000/- during first year.



### Source

The Director, ICAR-Central Inland Agricultural Research Institute, Post Box No. 181, Port Blair- 744 101, Andaman and Nicobar Islands, India.

## CULTURE OF LIVE BEARER ORNAMENTAL FISH USING PROBIOTIC FEED

Ornamental fish breeding and trade provide excellent opportunities as a non-food fishery activity for employment and income generation. The major live bearers are guppy, platy, mollies, sword tails etc. In fish culture, feed constitutes >50% of total production cost. In fish nutrition antibiotics and drugs are widely used as feed additives. The use of these drugs reduces the natural defense mechanisms of the fish and, therefore, alternate therapy using probiotics is encouraged. The technology envisages the use of pure culture of probiotic in fish feed and its use in ornamental fish rearing.

### Scope

Suitable for small scale and large scale ornamental fish farming, easy to prepare and apply.

### Cost

Contact to the Head of the Institute\*.

### Benefits

- Probiotic therapy protects fish against enteric pathogens.
- It improves the nutritive value of fish feed and growth of fish.
- It stimulates non-specific immune responses of fish.
- It increases the disease resistance of fish.
- It increases the fecundity of fish.



### Source

\*The Head, Department of Aquatic Animal Health, Faculty of Fishery Sciences, WBUAFS, Chakgaria, Kolkata-700094.

# CULTURE OF ORNAMENTAL FISH USING GARLIC SUPPLEMENTED FEED

Ornamental fish culture has very good scope in employment and income generation. In fish feed, antibiotics and drugs are widely used as feed additives. The use of these drugs reduces the natural defense mechanisms of the fish and, therefore, alternate therapy using herbal compounds is encouraged. The technology envisages the use of garlic bulb extract in fish feed and its use in ornamental fish rearing.

## Scope

Ideal for small scale and large scale ornamental fish farming, easy to prepare and apply.

## Cost

Contact to the Head of the Institute\*.

## Benefits

- Herbal therapy protects fish against enteric pathogens.
- It improves the growth of fish.
- It stimulates non-specific immune responses of fish.
- It increases the disease resistance of fish.



## Source

\*The Head, Department of Aquatic Animal Health, Faculty of Fishery Sciences, WBUAFS, Chakgaria, Kolkata-700094.

## CAROTENOID RICH ORNAMENTAL FISH FEED

The ornamental fish trade is very much dependent on achieving vibrant colour. Colour enhancement through the use of natural carotenoids in feed is one of the measures to enhance coloration and brightness of the colourful ornamental fish. Since carotenoids are only synthesized by plants and modified in animal tissues, fish must obtain them from their diet. It is advisable to ensure that ornamental fishes obtain a constant intake and adequate level of carotenoids in their feed. Among the natural carotenoids sources, red marigold flower meal was identified as the richest sources of  $\beta$ -carotene, canthaxanthin and xanthophylls. Incorporation of red marigold flower meal in the diet of ornamental fish like rosy barb, dwarf gourami and swordtail was found to be an effective colour enhancer at a cheaper price without any adverse effect on growth and body composition of fish.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

Contact to the Director of the Institute\*.

### Benefits

The feed additive can be used by the aquarists especially hobbyist, hatchery managers and breeders to enhance desired colour of ornamental fish to increase the marketable value. This is a proven technology for gold fish, blue gourami, sword tail and other common ornamental fish.



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

Or

The Scientist-In-Charge, ICAR-Central Institute of Fisheries Education (Deemed University), Kolkata Centre, 32-GN Block, Sector-V, Salt Lake City, Kolkata-700091, Tel: 033-23573893/7265/5269, Fax: 033-23573469, Website: [www.cife.edu.in](http://www.cife.edu.in).

## PELLET FEED FOR PRAWN BASED CARP POLY CULTURE

Traditionally farmers are using mixture of oilcakes and rice bran at 1:1 for prawn based carp polyculture. Traditional feed mixture supplies protein 18-20% which is lesser than requirement. CIFE, Kolkata Centre developed both steam compressed pellet and extruded pellet feed and feeding methods for prawn based carp polyculture based on feed utilization and growth performance. The feeds were tested in the farmers' ponds.

### Scope

Andaman & Nicobar Islands and West Bengal.

### Cost

The cost of steam compressed pellet is Rs. 20/- per kg and extruded pellet is Rs. 25/- per kg.

### Benefits

This feed will be beneficial over the traditional feed and feeding for optimum production of carp and prawn under polyculture system.

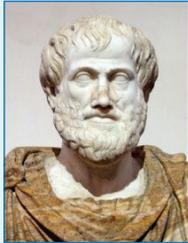


### Source

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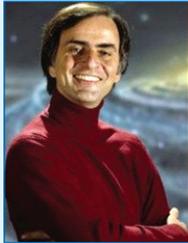
Knowing yourself is the beginning of all wisdom.

- Aristotle

# CHAPTER 4

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## Marine Capture Fisheries and Mariculture



Somewhere, something incredible is waiting to be known.

- Carl Sagan

## CAGE CULTURE OF COMMERCIALY IMPORTANT MARINE FIN FISHES IN PROTECTED BAYS AND CREEKS OF ANDAMAN

Groupers and snappers belonging to *Cephalopholis* spp. (*C. argus*, *C. minieta*, *C. boenex* and *C. milliaris*), *Epinephelus* sp. (*E. merra*, *E. fasciatus* and *E. longispitis*) and *Lutjanus* sp. are most abundantly available in Andaman waters. They can be collected from wild and stocked in cages. Feeding can be done every day with low value fishes like *Sardinella* sp. and trash fishes at 5 to 10% of body weight. 5 m x 4 m x 3 m (four cages together) wooden framed four cages together, 24 empty barrels, 2 anchors of 50 kg and net webbing and fish juveniles are required for the purpose.

### Scope

It is suitable in all protected waters of Andaman Islands.

### Cost

Capital investment is Rs. 2,00,000/- (cage construction) and juvenile/ adult fish collection and feeding cost is Rs.1,25,000/-.

### Benefits

- Stocking of fish fingerlings is @ 300 numbers with average weight of 400 g. The approximate yield is 240 kg after 6 months. The expected market rate is Rs. 700/- per kg. The net benefit per 6 months is Rs. 43,000/- (Rs.1,68,000/- Rs.1,25,000/-) from single cage.
- Profit will start from third year onwards, however, if the unit are increased to four cages overall maintenance cost will come down, the profit can be achieved from the second year onwards.



### Source

The Director, ICAR-Central Island Agricultural Research Institute, Post Box No. 181, Port Blair- 744 101, Andaman and Nicobar Islands, India.

## IMPROVING FISH CATCH THROUGH POTENTIAL FISHING ZONES ADVISORIES

Potential Fishing Zone (PFZ) disseminations are usually intimated through fax and email by INCOIS and disseminated by ICAR-CIARI through digital display boards, phone and messages. This improves in the faster dissemination of PFZ advisories generated at INCOIS. The DDBs provide ocean state forecasts, wind speed, tsunami warning and related information for the advantage of fishermen. The DDB is the primary mode of dissemination of PFZ forecasts followed by free distribution of PFZ maps. Percentage success of PFZ forecasts was 90% with an average increase of 34% in total catch per unit effort. Scouting time for fish shoal has been decreased drastically (51%).

### Scope

The Islands are underexploited in terms of fishery resources and hence, suitable for enhancing fish catch in Islands.

### Cost

These advisories are distributed to the fishermen free of cost by ICAR-CIARI, Port Blair.

### Benefits

| Vessel     | Mean cost of operation per trip (Rs.) | Average receipt (Rs.) |                    | Benefit/cost (Rs.)    |                    |
|------------|---------------------------------------|-----------------------|--------------------|-----------------------|--------------------|
|            |                                       | Without PFZ forecasts | With PFZ forecasts | Without PFZ forecasts | With PFZ forecasts |
| Gillnetter | 3758                                  | 5911                  | 12850              | 1.58                  | 3.41               |
| Trawler    | 60000                                 | 94864                 | 225560             | 1.58                  | 3.75               |
| Longliner  | 80000                                 | 145020                | 277440             | 1.81                  | 3.46               |

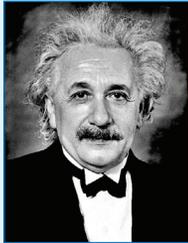
### Source

The Director, ICAR-Central Island Agricultural Research Institute, Post Box No. 181, Port Blair- 744 101, Andaman and Nicobar Islands, India.

# CHAPTER 5

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## Value Addition and Post-Harvest Technology



Two things are infinite: the universe and human stupidity; and I'm not sure about the universe.

- Albert Einstein

'Boneless whole carp' technology has been developed using a manual deboning procedure, without distorting the shape of fish. Spiced boneless carp is a ready to use product in retail market. Roasted whole carp can be very good fast food item as a carry home pack.

## Scope

Andaman & Nicobar Islands and West Bengal.

## Cost

- Processing product development and marketing will definitely help in boosting the carp industry.
- The average cost of production of the products was estimated to be Rs. 100/- per kg with a sale price of Rs.150/- per kg and a sale of 50 kg per day of value added products (26 days a month) the average monthly income of carp processing unit came to be approximately Rs. 65,000/-.

## Benefits

- Carp has less market value due to presence of intramuscular bones. Boneless convenience products for enhancing the consumer acceptability of carps has been developed. The method of deboning carps and value added carps products were transferred to some women self-help groups (SHGs) for empowerment and employment generation. The effort was to create a domestic and an international market for the fish as a low cost, boneless, healthy, value added precooked and flavored fish product acceptable to consumers.
- Carp must be deboned and processed into value added products to be a valuable commodity that can be sold in the retail grocery and institutional food markets. With the changing requirements and habits of the consumers the need for an increased market supply of ready-to-cook (fillets, nuggets, chunks etc.) and ready-to-serve (battered, breaded and fried fast food products) have come to fore front.



## Source

The Director, ICAR-Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-751002, India. Tel: 916742465421/ 2465446, Fax: 916742465407. E-mail: director.cifa@icar.gov.in. Web: <http://www.cifa.nic.in>.

## READY-TO-EAT FISH MEAT FORTIFIED SNACK (FISH MUNCH)

Extrusion technology is becoming very popular across the world to produce puffed and crispy snacks. Fish munch is an extruded fish product. Usually, starch is used for extrusion because of their temperature tolerance and desirable behavior at high temperature. Addition of protein adversely affects the crunchiness of the product and usually not exceeded beyond 5%. ICAR-CIFE, Mumbai has developed the unique technique of blending up to 25% fish protein (a level that is equal to the protein content in fish) in to extruded product. A temperature controlled twin screw extruder is used for unique blending of starch and protein from different sources. The extrusion parameters (feeding rate, moisture, barrel temperature, die diameter and screw speed) have been optimized. Three-layered laminated pouch from aluminum and polyester were developed for nitrogen packing and storage. The product has a shelf life of over 4 months.

### Scope

Low cost fish has been utilized to make this product cheaper and for better use of the commercially unimportant fish.

### Cost

Contact to the Director of the Institute\*.

### Benefit

Income will be increased due to sale of value added fish/ fish products.

### Users/ Entrepreneurs/ Manufactures

The technology has been transferred to M/s Vijaya Infra Project (Pvt.) Ltd., Mumbai.



### Source

\*The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

# READY-TO-EAT FISH SANDWICH SPREAD IN RETORT POUCHES

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Sandwich is the most popular ready-to-eat food all over the world and its fortification with fish meat is an effective tool against nutritional deficiency. A novel technology was developed at CIFE, Mumbai to produce ready-to-eat fish sandwich spread in retort pouches by utilizing low cost fish and fish oil rich in omega-3 fatty acids. The technology involves utilization of low cost fish mince and/ or fish oil to produce fish based spread in retort pouches, optimization of retorting conditions to get desirable nutritional and textural properties with improved oxidative stability, spread ability and texture of final product. It has been changing from whole, frozen foods through ready-to-cook products to finally ready-to eat products.

## Scope

The demand for ready-to-eat fish products is increasing both in domestic and international market because of health benefits associated with fish and fishery products.

## Cost

Production cost for each pouch of sandwich paste is Rs. 3.75/-.

## Benefit

The storage characteristics were studied and found that the product showed no significant changes during 12 months of storage period.

The image displays the packaging for 'Fish Sandwich Spread'. The top banner reads 'Ready-to-Eat CIFE Product'. The main title is 'Fish Sandwich Spread'. Below the title, it states 'made from fresh fish meat' and 'good with bread or pav'. The central image shows the spread on a white plate. To the right, there are icons for ingredients: fish mince, potato, and spices. Below this, it says '100% Natural with good readability' and 'Preservatives added for self-life of six months at room temperature'. The nutritional facts per 100 g are: Protein - 10.5 g, Fat - 13.5 g, and Carbohydrate - 8.0 g. The 'Instruction to consume' section provides two methods: 1. Immerse the pouch in boiling water for 5 min, then cut open and serve hot. 2. Or, transfer the contents into a bowl and microwave for 1-2 min and serve. The bottom of the packaging features the logo of the Central Institute of Fisheries Education (CIFE) and the text: 'Developed by Central Institute of Fisheries Education (Deemed University-ICAR), Panch Marg, Off Yari Road, Andheri (W), Mumbai - 400061, www.cife.edu.in'.

## Source

The Director and Vice-Chancellor, ICAR-Central Institute of Fisheries Education (Deemed University), Panch Marg, Off Yari Road, Versova, Mumbai-400 061, Tel: +9122 2636 1446/7/8, Fax: +91 22 2636 1573, Website: [www.cife.edu.in](http://www.cife.edu.in).

## DEVELOPMENT OF FISH SNACKS USING SURIMI POWDER PREPARED FROM TILAPIA

The term surimi refers to concentrated myofibrillar protein extracted from fish flesh by washing minced meat that has been separated from bones, skin, and guts. Today, surimi is a popular food item in many countries due to its unique textural properties and high nutritional value. Surimi can be produced from both marine and fresh-water fish, including both white-muscled and dark-muscled fish. Recent research indicates that surimi could be converted to a dried form-surimi powder. In its powdered form, surimi can be kept without frozen storage. The powdered surimi offers many advantages in commerce, such as ease of handling, lower distribution costs, more convenient storage and usefulness in dry mixes application. Surimi powder that maintains the functional properties of protein is a potentially useful raw material for making seafood products. Besides gel-based products, surimi powder may prove useful for making friable food products such as crackers.

### Scope

- Paves the way for income generation of rural unemployed.
- Enables the utilization of underutilized fish species.
- Offers a remarkable opportunity for development of value added products like fish snacks.

### Cost

Contact to the Head of the Institute\*.

### Benefits

- Value addition to low cost fishes.
- Income generation of rural unemployed.



### Source

\*The Head, Department of Fish Processing Technology, Faculty of Fishery Sciences, WBUAFS, Chakgaria, Kolkata-700094. Ph.: 03324328749.

# CHAPTER 6

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## Fishing Gears



Either write something worth reading or do something worth writing.

- Benjamin Franklin

## DESIGNING OF SEMI-PELAGIC HIGH OPENING SELECTIVE POMFRET TRAWL NET

Pomfret is an important by-catch in trawl fishing. It is one of the important species of demersal fishery along the upper coast of the Bay of Bengal. There is a threat to pomfret fishery due to indiscriminate shrimp fishing by trawl net. Unlike shrimp fishing, the gear used for the capture of pomfret is not specific. A new design of semi-pelagic trawl net is developed for selective pomfret fishing.

### Scope

This ecofriendly semi-pelagic high opening selective pomfret trawl net is most ideal for West Bengal, as 17% of the total catch composition was pomfret in West Bengal coast.

### Cost

The total cost comes around Rs. 2, 00, 000/-.

### Benefits

- Catch target species of allowable size.
- Ecofriendly, cause minimum damage to other organisms.
- Reduce drag and power requirement.
- Better fuel efficiency.

### Source

The Head, Department of Fishery Engineering, Faculty of Fishery Sciences, WBUAFS, Chakgaria, Kolkata-700094.

## ECO-WINTER MIGRATORY BAG NET (EWMBN) WITH SQUARE MESH TECHNOLOGY FOR SELECTIVE FISHING

This square mesh technology is in contrast to diamond meshes which tend to close under tension. The size of fish able to escape will depend on the mesh size and mesh shape. Square shape mesh panels and windows are usually fabricated from locally available knotted netting. Then, incorporated in forward part of upper belly and cod end of EWMBN to improve escapement rates and prevent shellfish loss. More than one mesh size may be used in the panels and cod end; however, the size of the panels at forward part of upper belly and at cod end will be based on personal choice.

### Scope

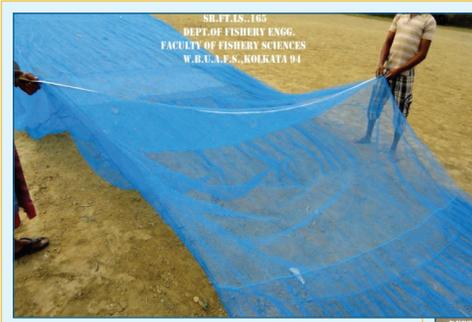
By-catch loss in terms of ecology is a very grave issue. Being an integral part of the ecosystem, it plays a major role in maintaining the equilibrium of the biological system. Developing new environmentally friendly fishing gears and practices (EWMBN) is a remedial measure to mitigate the problem of by-catch loss. It can be promoted for better selectivity and long term management of estuarine resources.

### Cost

The cost ranges from Rs. 85, 000/- to Rs. 1, 25, 000/- depending on size of the net.

### Benefits

Eco-winter migratory bag net (EWMBN) is environmentally friendly which ensures the reductions of the by-catch loss in terms of escapement of the juveniles and retaining the sizeable and commercially viable fishes.



### Source

The Head, Department of Fishery Engineering, Faculty of Fishery Sciences, WBUAFS, Chakgaria, Kolkata-700094.