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ISSN 2581-7892

Volume 4, Issue No.9 | September 2021

Aquaculture Spectrum™

The Indian Aquaculture Magazine

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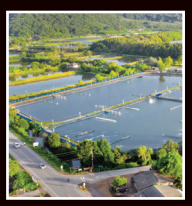

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Aquaculture Spectrum is a monthly publication by Aquaculture Outlook. Aquaculture Outlook presently publishes two editions; Aquaculture Spectrum in English and Jala Sedhyam in Telugu.

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Annual Subscription Charges for Aquaculture Spectrum:

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Mobile no: 9381944445 / 9381944442.

Edited, Printed and Published by Jaideep Kumar on behalf of M/s. Aquaculture Outlook, printed at Safire Offset Printers, 3/49, Ayyanar Colony, Vembakottai Road, Sivakasi 626 123, Tamil Nadu and published from:

Aquaculture Outlook,

Flat No. A3, Plot No.1, 3rd Floor, Nahar Mathura, Sri AadhiVaragha Puri, Thiruvidanthai, Kancheepuram District, Chennai-603112, Tamil Nadu.
Registered with the Registrar of Newspapers for India with Reg. No. TNENG/2018/76151; ISSN 2581-7892

Cover page:

Photograph of Ramachandra Biswal of Ramakrishna Aquafarms, Karlapalem Mandal, Guntur district, Andhra Pradesh, holding harvested Black Tiger Shrimp

NATIONAL BROODBANK OF POMPANO

SERVING THE MARINE FINFISHFARMING SECTOR OF INDIA

Anil M.K, Ambarish P Gop, Surya S, Gomathi P, Santhosh B, Swathilekshmi P S, Shoji Joseph*, Raju B, Praveen P, Krishnapriya P.M Shalini O, Anand V and Gopalakrishnan A*.

*Vizhinjam Regional Centre of CMFRI, Thiruvananthapuram, *CMFRI, Kochi*

The development and expansion of marine finfish aquaculture in India can lead to enhanced seafood production, both for domestic consumption as well as for export. However, the expansion and commercialisation of this activity is restricted, mainly due to the limited or non-availability of seeds of high-value finfishes. Silver pompano, Indian pompano, cobia, seabass, selected grouper varieties, sea breams and snappers are some of the key species that can be targeted as candidate species for commercial level seed production in the country. The prime requirement to achieve this goal is to ensure year-round commercial level availability of hatchery-produced seeds of such species, for which, controlled reproductive maturation under bio-secure conditions is essential. Unlike some species of shrimps, it is not easy to source the required brooders directly by wild collection. It is time-consuming to collect pre-adult fishes from the wild and condition them into brooders (broodstock development). Hence, a viable option is to establish a broodstock holding facility (Broodbank) where broodfishes can be developed and maintained under bio-secure conditions. Broodbanks facilitated with recirculating aquaculture systems (RAS) can to a large extent, avoid unexpected mortalities of brooders. Induced or volitional breeding techniques can be applied here, and fertilised eggs and newly hatched larvae can be supplied on demand to commercial hatcheries for rearing.

Background

The realisation on the lack of adequate diffusion of scientific information/technologies from research to the farming community and lack of marine fish seed in quantity and quality led to the establishment of the DoF-NFDB-ICAR CMFRI Technology Upgradation Project entitled, **"Enhancing the production of Silver Pompano Trachinotus blochii through the establishment of a brood bank, supply of larvae to states/UTs for seed production"** at the Vizhinjam Regional Centre of the Central Marine Fisheries Research Institute (CMFRI), Thiruvananthapuram, Kerala at an estimated cost of Rs. 5.644 crores.

National Broodbank of Pompano at Vizhinjam, Thiruvananthapuram

Silver Pompano – Trachinotus blochii

This project is among a series of initiatives by the Department of Fisheries (DoF-GoI), Government of India, through the National Fisheries Development Board (NFDB), aiming to popularise marine finfish farming in India, by supporting the establishment of hatcheries. Primarily, we have sought to underpin the rapid development of the Indian marine fish farming industry, which has just begun to develop, by increasing marine finfish seed supply, opening opportunities for selective breeding and increasing the understanding of marine fish seed production.

The impetus for this project began in 2016, following discussions between Dr. V. V. Sugunan (Senior Consultant, NFDB), and Dr. A. Gopalakrishnan, (Director CMFRI), regarding the diffusion of scientific information/technologies from Research Institutes to the farming community. The project was finalized and presented before NFDB and Secretary DAHDF, GoI, after detailed discussions with the officials of the Fisheries Departments of Kerala, West Bengal, Goa, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. The project, with a total outlay of Rs. 5.644 crores was cleared by the Ministry with 100% financial assistance from NFDB and it commenced during November 2017.

Objectives of the project

CMFRI proposed to accomplish two key objectives through the project to disseminate the seed production and culture technologies of silver pompano by:

- Producing and supplying 48 million yolk sac larvae of silver pompano to Government / private hatcheries for seed production by establishing a National Brood Bank at Vizhinjam Research Centre of CMFRI, and

- Triggering interest among farmers and hatchery operators to take up pompano aquaculture through training on broodstock development, larviculture, live feed production, nursery and farming methods to entrepreneurs/fishers/SHGs/Co-operatives/Fisheries Department Officials.

CMFRI has been intensifying its research on the breeding and seed production of high-value marine finfish since 2004 through its in-house projects and in collaboration with the National Agricultural Innovation Project (NAIP). The first breeding success was achieved in 2010 for cobia and subsequently for silver pompano in 2011 at its Mandapam Regional Centre. CMFRI were already successful in indigenously developing and standardising broodstock development of marine fishes in Recirculating Aquaculture Systems (RAS) at its Vizhinjam Regional Centre in the NIAP on Mariculture, which has been running since 2015, even before the commencement of the Broodbank project. Technology for broodstock maintenance and larval rearing was also fine-tuned under this project and used for the Broodbank project.

Infrastructure developed

A one-acre seafront property was leased out from the Govt. of Kerala for a period of 99 years for the development of the hatchery. The plot exists in two levels, about 35 cents in the upper level and remaining at the lower level. Three buildings were constructed on the plot with the top-level 1700 sq. feet building comprising of a reception area, two scientist rooms, two laboratories, a resident scientist's room, store and work areas. A 50-ton overhead storage tank is located behind this building. While one lab has been developed for keeping the stock culture of microalgae and equipped with advanced stereo and research microscopes, the second laboratory is equipped with various instruments for water quality measurements.

On the lower level, there are two buildings; a two-storied building (7800 sq. feet) houses the live feed culture rooms, training hall, air-conditioned store for keeping the feeds and a store for keeping other consumables on the first floor. The pre-existing ground floor is used to house the 12-ton RAS, 5-ton larval rearing tanks and six-ton D shaped tanks for juvenile rearing for fingerling production. A light roofed area has been created outside the building with transparent roofing, that is used for larval rearing, mass phytoplankton production, rotifer culture and artemia hatching.

Office and Laboratory Building

Laboratories created at the Broodbank facility

The third building of 1900 sq. feet area, located behind the above mentioned building houses three units of 30-ton RAS tanks used for rearing the fish to the adult sizes. Fish from this stock were selected to be stocked in 10 - 12 t systems for creating breeding stocks.

The water intake system consists of 5 HP pumps that draws seawater directly from the sea. Water passes through two high-pressure sand-filters, into a 50 -ton tank with settlement and storage sections. Stored water is chlorinated and dechlorinated and pumped to a 50-ton overhead tank from where water is delivered to various sections after passing through cartridge and UV filters. In addition to this, all the RAS units have separate filtration systems and seawater is recirculated at least 12 times in 24 hrs. The use of RAS minimises the quantity of water required daily.

Methodology

Broodstock Collection and Transportation

Broodstock collection began simultaneously with the construction work at the seafront plot. Before starting collection of fish for broodstock development, the water filtration and storage facilities at the existing temporary facilities attached to the CMFRI office complex were improved by installing high-pressure sand filters, ozoniser and UV systems for water purification. Three 10-ton HDPE tanks were purchased to enhance the storage capacity of the temporary hatchery. Further, four 10-ton and five 5-ton Recirculating aquaculture systems (RAS) were set up. The 30-t concrete RAS at the complex was also used for stocking the broodfish.

Most of the fish used for the development of the broodstock were collected locally from Kayamkulam, Vizhinjam, Kanyakumari, Tuticorin, and Rameswaram areas. They were in the size range of 100 - 500 g; with an average size of 250 g. Fish were transported using a dedicated pickup van purchased exclusively for the project. The fishes would be immediately transferred to the filtered and aerated seawater filled in the HDPE tank kept in the van at the collection site. One holding tank of Fibre glass or triple-layered plastic tanks (Aquatech, India) of suitable capacities like 500 or 1000 L was used for transportation. Aeration was given using a battery-operated aerator or generator operated

Main hatchery building

Photobioreactor facility for high-density microalgal production

mini-blower. The collection process of broodfish always leads to a high level of physiological stress in the fish. To resolve this, a high level of dissolved oxygen is necessary for them to recover from the oxygen debt. An oxygen cylinder was also placed in the van for use during transportation to ensure better survival.

Stocking density of the fish during transportation is a critical factor that determines the survival of the brood fish. A stocking density of 1kg/500 L is found advisable for the transport of silver pompano. The preferred transportation time is during early morning hours or night hours to avoid higher temperatures during the day. Ice blocks wrapped in polythene bags were added to the holding tank during transportation to prevent increase in water temperature.

Growing brood fishes from hatchery-produced seed in cages

In addition to the wild-caught sub-adults, hatchery-produced fingerlings of silver pompano were also reared in cages at Ashtamudi Lake, Kollam for the purpose. Around 1500 fingerlings weighing 10-15g size were stocked in a circular GI cage of 6m diameter and a square cage of 4m x 4m size. Stocking was carried out at 20/m^3. Later it was partially harvested at around 250g and only the fast-growing and healthy fish were retained in the cage. Final stocking density was maintained as 10/m^3. Fishes were fed with commercial pelleted feed containing 40% protein.

Cages were also installed at the Prakkulam area of Ashtamudi considering the conducive salinity profile, water flow, productivity, depth and other environmental parameters. Around 300 fishes of 1 - 2 kg size are being maintained in these cages as buffer stock and being fed with commercial pellet feeds. Subadults of the fishes with a size above 500g were transported live to the hatchery, as and when required.

Quarantine

Prior to introduction of the broodfish into the system, and as a part of the quarantine process, the fishes were treated with formalin at the rate of 10 ppm as bath

treatment for five consecutive days, with 200 % water exchange (100 % two times) each day. Dip treatment with chloroquine phosphate (Lariago 250 mg tablets; Ipca Laboratories Pvt. Ltd.) at a dosage of 500mg/ 100 L of water for five days was found effective for Pompano. Short time exposure of brooders (maximum 5 minutes) in freshwater and treatment with 100 ppm formalin for 2 - 5 min, were also found helpful to remove the external parasites before transferring them to broodstock tank. The quarantine treatment required a minimum of 14 days.

Fishes were brought and reared in 30-t RAS equipped with drum filters and protein skimmers for physical filtration and biological filtration units with MBBR media kept fluidised for improved ammonia removal. The water line is connected to the chiller unit to regulate the temperature, and finally seawater passes through UV filters before delivering into the tanks. Some tanks were provided with photothermal regulation, but most of the systems are without photothermal systems and were maintained at the natural photothermal regime, and as the hatchery is located in the tropics, it provided almost 12 h L:12h L at 26-28º C. There are three 30-t and five 12-t and four-10 t and ten 5-ton RAS.

By November 2018, a broodstock count of 100 pompanos were in the various stages of maturation, with a few larger ones nearing maturation. Fishes were tagged using PIT tags, and growth and maturity were monitored continuously. Passive Integrated Transponder (PIT) tag, also known as radiofrequency device, is used to mark fish internally permanently. The tag is designed to last throughout the life of the fishes providing a reliable, long-term identification. Regular cannulation was done to find out mature spawners. Out of the total brooders available, 75% were identified as *Trachinotus blochii* (Silver Pompano), and the remaining 25% were the Indian Pompano, *Trachinotus mookalee*.

Broodstock management

The broodfish were fed with low valued fish, squid, mussel meat and prawns. As growth progressed further, the bigger and fast-growing ones with progressing stages of maturity were transferred from 30 t systems to 12, 10 or 5 t tanks for developing them into spawning groups of three to four fishes; they were segregated by sex and kept in tanks at a sex ratio of

12t RAS broodstock tank with 5t and 3t larval rearing tanks

Units of the 30 tonne Recirculating aquaculture systems

Broodstock in 30t RAS tanks

2:1 (male: female). Segregation of fishes was done by cannulation and tagging process. They were also given a supplementary dose of Vitamin C and E. Maturity state of fishes bigger than 1.5 kg were continuously monitored by cannulation.

It is preferable to use round tanks for maturation to ensure proper water circulation and movement. Silver pompano is a comparatively fast-swimming fish and

Collection and transportation of pompano brooders from wild

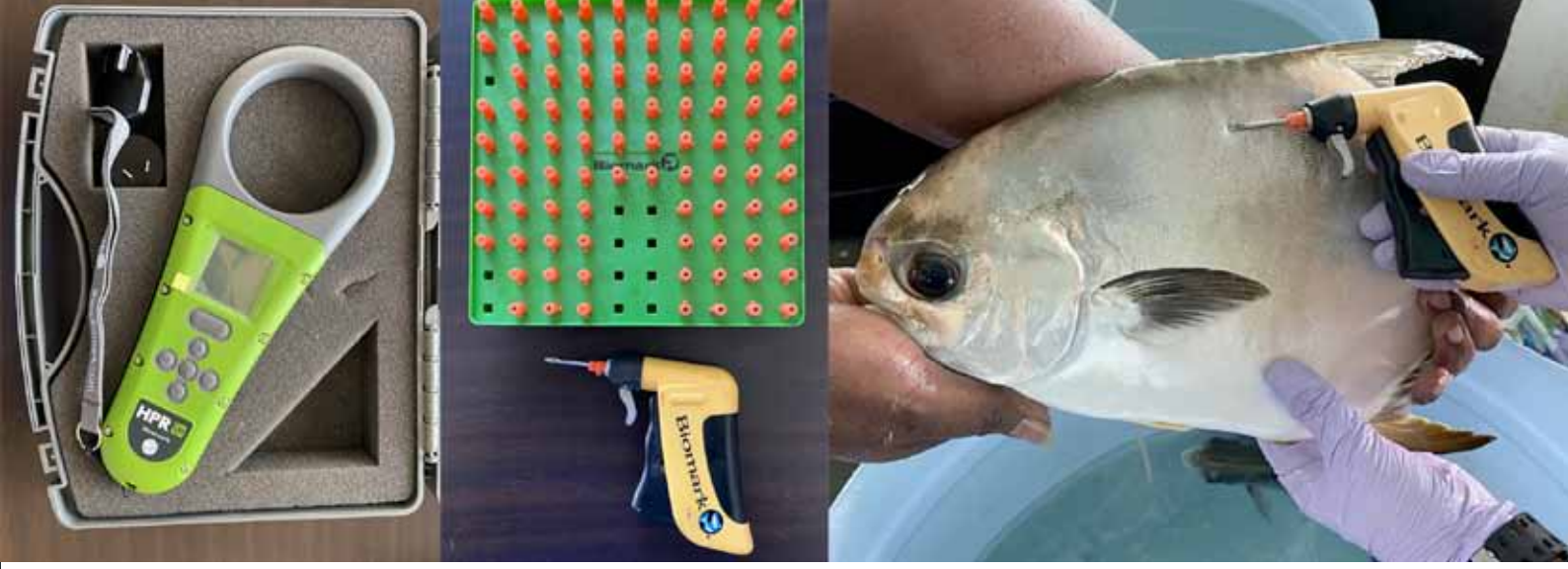
sometimes tends to jump out of the tank with slight disturbance. Therefore, the tanks were covered with a net. The stocking density of brood stock maintained in RAS was 1kg/1000L. Pompano broodstock performed better in circular RAS tanks with 10/12 Ton capacity. Buffer broodstock is maintained in 30-t RAS and cages.

Induced Breeding

In the case of males, once a broodfish is identified as a mature male, they are left undisturbed, whereas regular monitoring of oocyte development were carried out in female fish at frequent intervals to assess its maturity. Oocytes collected via cannulation were observed under microscope to analyse the diameter of the eggs. Flexible, sterile catheters (1.2 mm internal diameter) are introduced through the genital pore into the oviduct for a few cm up to the ovary and then gave a mild pressure to suck out the oocytes. The oocytes thus obtained can be observed under a microscope to assess the gonadal maturity. Fishes are induced to spawn; when the oocytes attain an ova diameter in the range 520 - 580 µm (usually >520 µm). A sex ratio of 1:3 (female: male) is maintained in the spawning tank for induced breeding, but a F:M ratio of 1:1 and 1:2 also had registered spawning success.

Induced breeding steps: Collection of broodfish from the tank, anesthetisation with MS222, tag reading of broodfish, cannulation, collection of oocytes, observation of oocytes under microscope, hormone injection of brooder, and collection of fertilized eggs.

Pompano subadults in the cage



Tagging: Tag reader, tagging needle and gun, Tagging of pompano

Earlier protocols developed using HCG have several disadvantages, and therefore a new protocol was developed using GNRH. An analogue of luteinising hormone-releasing hormone [LH-RHa des-Gly10 (D-Ala6) LH-RH ethyl amide, acetate salt] has been successfully used as a replacement for HCG based induced spawning. Here fishes were induced using commercial grade LH-RHa (Trade name- Buselin) at a slightly higher dosage than the research grade. The dosage was standardised at 150 µl per kg body weight for females and 75 µl per kg body weight for males though it varied with maturity stage and age of fishes with old broodfish requiring lesser dosage. Usually, spawning could be observed within 36 - 48 hours after hormonal induction. The spawning in pompano usually takes place between late night and early morning hours. The number of eggs spawned by pompano brooders ranged from 1.5 to 2.5 lakh eggs (female bodyweight 2-2.5 kg). The fertilised eggs of pompano float at the surface.

Larval rearing and seed production

After spawning, floating eggs were collected from the side drain (overflow outlet) by tying a fine mesh bag to the overflow conduit and by sieving the surface using 250 - 500 µ mesh cloth. Fertilised silver pompano eggs are pelagic, transparent and non-adhesive with a single oil globule, and measure 0.9 - 1.0 mm in diameter. Eggs were collected from the broodstock tank, preferably at the optic vesicle stage of embryonic development, which is considered safer for transfer.

Collected fertilised eggs were transferred to a known volume of seawater; after thorough mixing, 2 - 3 subsamples (5 - 10 ml) were taken, and eggs were counted. The total number of eggs are estimated by multiplying the average egg count in the samples with the total volume of seawater used.

Circular FRP tanks of 3 to 5-ton capacity with a water depth of 1.2 m were used for larval rearing. Only fertilised floating eggs were sourced and used for larval rearing after treating with 30ppm iodophor for about 10 min. Newly hatched larvae measured 1.9 to 2.0 mm. Pre-treated filtered seawater of 35 ppt passed through UV filter is used for larval rearing. Eggs are stocked at a density of 10 nos./L in green water with *Nanochloropsis* sp. and *Isochrysis galbana*. Rotifer is used as the first feed, followed by artemia nauplii and subsequently weaned to artificial feed. Metamorphosis of Larvae begins at 18 - 21 dph.

Fingerling production

Around 25,000 - 30,000 nos. of metamorphosed larvae of 1.5 cm size were transferred to a 6-ton capacity tank and were fed with an artificial diet of 300/500 µ size till 40 dph. Subsequently, the juveniles were fed with the 800 µ pellet feed. Larvae were fed to ad libitum level at 7.00 am, 12.00 am, 4.00 pm and 6.00 pm. 100% water was exchanged daily in static systems. Juveniles attain 5 - 7 cm after 45 - 60 days of rearing. In RAS fingerling production systems, higher stocking density can be used with just around 10% water exchange.

Packing and transportation of egg/ seed

Eggs after counting are transferred to 32" x 16.5" polythene bags with 1/3rd of water (four litres for packing seeds and six litres for packing eggs) and 2/3^{rds} of oxygen. The stocking density of eggs per bag varies with travel distance and hours of transportation to reach the destination. It is better to keep the dissolved oxygen at around seven ppm for long-duration transport.

Tag reading, cannulation, collected eggs, eggs under the microscope, hormone injection and collected eggs

Transfer of Technology

Training programs for awareness creation and skill development were conducted at the Vizhinjam Regional Centre of CMFRI as a regular feature under the project during which hands-on training was given to farmers, officials and private entrepreneurs on hatchery production, as well as pond and cage culture practices, during the period from 2017 - 2021. A total of six on-campus/on-farm training programmes and two virtual training programmes were imparted on Broodstock maintenance, larval rearing, hatchery production of the high-value marine finfish Pompano as well as on cage farming. Field visits to cage sites of practising farmers, SHGs, private entrepreneurs and hands-on training on various steps of hatchery production of marine seeds of Pompano were covered under the training curriculum.

Output

- Broodstock of 100 pairs of Silver Pompano *Trachinotus blochii* in RAS
- Broodstock of 40 pairs of Indian Pompano *Trachinotus mookalee* in RAS
- Achieved a production capacity of 50 million yolk-sac larvae/year
- Seed production capacity: 0.7 to 1 million per year
- A total of more than 80 million yolk-sac larvae was produced and used for seed production and for distribution to farmers, hatcheries and research institutions.
- Maximum daily egg production > 1 million per day
- New protocol developed for induced breeding and larval rearing
- State of the art RAS facility created, advanced larval rearing and live feed production systems established
- Training imparted to more than 500 beneficiaries and 25 officials
- MoU was signed with following hatcheries for egg/yolk-sac and advanced larval supply,
  - Kerala State Pompano Hatchery, Azhikode, Kerala
  - Canares Aquaculture LLP, Kumta, Karnataka
  - MATSYAFED Valiancode Hatchery, Ponnani, Kerala
  - Ananda group, Bhimavaram, Andhra Pradesh
  - Jay Jay Aquatech, Pondicherry
- Seed supply to 6 maritime states and Union Territory of Lakshadweep

Packing, transportation and sales

The outcome of the project

The project sought to enhance productivity and improve rural livelihoods in India by promoting high-value marine finfish aquaculture by developing and transferring environmentally appropriate and climate-resilient aquaculture technology that will support industry expansion. The 'new' candidate species, Silver and Indian Pompano were targeted to contribute to "Improved performance of key aquaculture sectors".

In India, pompano seed supply has increased, and marine finfish mariculture production has more than doubled over the span of the program. Farming is now spread across six states and the Union Territory of Lakshadweep, and **pompano production has been conservatively estimated to have exceeded 800 tonnes/annum**. Community involvement has increased, with an estimated 500 coastal-dwelling families now benefitting from the cage culture of pompano. New cage and pond culture facilities have been created, and investment in the industry is improving.

All fundamental requirements to ensure a bright future for high valued marine finfish farming in India has been achieved through this programme. This includes, training of cage farmers and hatchery personnel (both from the state Government and the private sector), conducting National webinars to create nationwide awareness and ensuring year-round supply of fertilised eggs, juveniles and fingerlings, entirely based on RAS based broodstock development and breeding program. A highly efficient and bio-secure rearing system with production protocols needed to produce marine finfish seed have been established and a total production of over 5 million seeds has been achieved. Critical to the future of the breeding program, we have also ensured that staff have the requisite skills necessary to maintain the breeding program.

Travel time (Hrs)	Stage of egg/seed size	Stocking density/ pack	Mode of packing/ transport
6 - 8	Egg*	25000	Oxygen filled packets
8 - 30	Egg	100000	1000L tank with oxygen supply
12 - 36	10 - 12 days old larvae	500	Oxygen filled packets
Up to 12 hrs	Seed of 1.5 cm (TL) size	150	Oxygen filled packets
12 - 48	Seed of 1.5 cm (TL) size	100	Oxygen filled packets

*Eggs in optic vesicle stage of embryonic development are preferred

Training programs conducted as a part of the project

The continuing research has made a number of significant contributions. Our understanding of the reproductive cycle of the Pompano in RAS systems has significantly increased. As a result of hatchery research, a new protocol based on GnRH/LHRH and advanced larval rearing technology has been developed and perfected. The technology has been disseminated to hatcheries in both the government and private sector, which has facilitated commercial high-value marine fish production in India.

Acknowledgement

We gratefully acknowledge the financial assistance extended by the NFDB for the project. We extend our sincere gratitude to Shri. Devendra Choudhary, IAS, Former Secretary, DAHDF, Ministry of Agriculture and Family Welfare, Dr. Joykrushna Jena, DDG (Fy), ICAR, Ms I. Rani Kumudini, IAS, former Chief Executive NFDB, Dr (Smt.) Suvarna Chandrappagari, IFS, Chief Executive, NFDB, Dr. V.V Sugunan, former Sr. Consultant, NFDB & Director, ICAR-CIFRI, Dr. G. Gopakumar, former Head, Mariculture Division, CMFRI and Dr. A.G. Ponniah, former Director CIBA. The support extended by Shri. G. Rathinaraj, Former Executive Director (Tech), NFDB, Ms. Sutapa Biswas (Project Consultant, Tech), NFDB, Dr. P. Paul Pandian, Former Fisheries Development Commissioner and Dr. Ansy Mathew N.P., Assistant Commissioner (Fisheries), Department of Fisheries (DoF), Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD), DoF, MoFAHD are also greatly appreciated.

NB. For further information on egg/yolk-sac larvae &seed supply and consultancy services please email us at: pompanovcmfri@gmail.com

VISHAKHAPATNAM BANS SELLING OF FISH ON FOOTPATHS

The Greater Visakhapatnam Municipal Corporation (GVMC) has banned the sale of fish on footpaths at Vishakhapatnam as the fish vendors are occupying places meant for the pedestrians. This practice is rampant in the city with over 600 vendors being involved. GVMC will be taking strong action against such mode of vending and the ward sanitary inspectors would also be punished if failing to take action on fish vendors on footpaths. According to the Fisheries Union, GVMC needs to set up additional hawking zones for fishermen in addition to the existing 32 fish markets in the city, so that they do not occupy footpaths or roads for their business. The roadside sale of fish is commonly seen at Chinna Waltair, Appu Ghar, Ramalakshmi Apartments Junction, BRTS Road, Visalakshi Nagar, Seethammadhara, MVP Colony, Murali Nagar, Gajuwaka, KRM Colony, HB Colony, Simhachalam, and Vepagunta.

Source: Deccan Chronicle

FISHERMAN EARNS RS 1.33 CRORE ON A CATCH OF GHOL FISH

A fisherman and his team from Palghar, Maharashtra have made a fortune of Rs. 1.33 crore by selling a whole consignment of 157 Ghol fish to a group of traders from Uttar Pradesh and Bihar on the first day of his fishing activity after the two-month-long monsoon ban that ended on August 15. Majorly found in the Indo-pacific region, the ghol fish is scientifically known as *Protonibea diacanthus* or the "Black spotted croaker fish" or 'Sea Gold' and is considered to be among the most expensive marine fish for its medicinal values, pharmaceutical use and for its great demand in countries like Indonesia, Thailand, Hong Kong, Singapore and Malaysia. It is high in nutrients such as iodine, omega-3, DHA, EPA, iron, taurine, magnesium, fluoride and selenium.

Source: India Today/ET

INDIAN GOVERNMENT EYES DEVELOPING SEAWEED ECONOMY

Jatindra Nath Swain, Fisheries Secretary to the government of India stated that the Central government is looking forward to developing a sustainable economy through highly prospective seaweed cultivation. At a time when climate change is increasingly posing a major threat to human life across the globe, cultivating seaweed, which is one of the natural methods to mitigate the global crisis, would help boost the economy and reduce the impact of climate crisis as well, he said while speaking at an interactive meeting with scientists of the Central Marine Fisheries Research Institute (CMFRI) held at its Headquarters in Kochi. He also stressed that this activity would be an additional livelihood option, and play a major role in the socio-economic upliftment of traditional fishermen during difficult times.

Seaweed Seedbank

The Fisheries secretary asked the CMFRI to set up a seedbank of seaweeds to popularise the practice among the coastal region and enhance seaweed cultivation on large-scale, adding that the Pradhan Mantri Matsya Sampada Yojana (PMMSY) has a special thrust for promotion of the seaweed farming. He was on a visit to Kerala, after taking over the portfolio four months ago, to understand the issues and challenges faced by the sector. Apart from those in the Kochi headquarters, CMFRI scientists from various regional research stations across the country also attended the meeting.

Doubling seafood export

Elaborating on the country's ambitious plan in the marine fisheries sector, the Fisheries secretary said that India is eying doubling the seafood export in the next five years by exploring innovative ways and adopting diversified mariculture activities such as cage farming to increase the production which will certainly upscale the country's per capita income. Flagging his concern on resource depletion and ecosystem degradation, he urged scientists to focus on ways to promote responsible fishing and to adopt appropriate mechanisms to improve sustainable fishing.

BANGLADESH AQUACULTURE ACTIVITY SUCCESSFULLY IMPLEMENTS BLOCKCHAIN TECHNOLOGY

Bangladesh Aquaculture Activity in partnership with Chennai-based company Byteally Software, successfully implemented a blockchain traceability system for a new fast-growing variety of carp aquaculture among select participants in Bangladesh. The aim was to create a traceable environment by gathering market-relevant data from all aquaculture supply chain participants using mobile and web applications. The project intends to foster sustained, positive aquaculture sector growth through an inclusive market systems approach. The blockchain technology can instill consumers' trust in the aquaculture value chain by capturing necessary market-relevant data. The direct beneficiary of this project would be the smallholder farms who would build trust with other market actors leveraging clean data, therefore optimizing supply accordingly.

Source: NEWAGE

Edited, Printed and Published by Jaideep Kumar on behalf of M/s. Aquaculture Outlook, printed at Safire Offset Printers, 3/49, Ayyanar Colony, Vembakottai Road, Sivakasi 626 123, Tamil Nadu and published from Aquaculture Outlook, Flat No. A3, Plot No.1, 3rd Floor, Nahar Mathura, Sri AadhiVaragha Puri, Thiruvidanthai, Kancheepuram District, Chennai-603112, Tamil Nadu.