



# ANNUAL REPORT 2013-2014



**Rajiv Gandhi Centre for Aquaculture**

MPEDA, Ministry of Commerce & Industry, Govt. of India

[www.rgca.org.in](http://www.rgca.org.in)



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# From the President's Desk



Ms. Leena Nair. IAS

The year 2013-14, has been the second year of the 12<sup>th</sup> Five Year Plan. For RGCA, it has been the year of successes, achievements in existing projects and planning for new activities relevant to the needs of the industry. All the ongoing programmes are being pursued in full throttle in order to fulfil its mandate of developing, demonstrating and transferring economically responsible aquaculture technologies for the benefit of aquaculture industry of the country with the continued support and guidance and support of the Scientific Advisory Committee and the Executive Committee of the Organization.

In the past one year there have been many accomplishments which are detailed in this annual report. The progress shown in the year 2013-14 is a stepping stone towards taking up further challenges in the sustainable aquaculture technology development front. The efforts, strong commitment & managerial qualities of the young scientists and staff members of RGCA catered the ongoing demands of the projects and improved the overall performance of the organization in the year 2013-14. I am impressed with the growth attained by RGCA during this year and the efforts put in by the organization to shape up the demand of our country in the sphere of technology developments for aquaculture by focusing on the momentum of technological advancement taking place around the world.

RGCA has enabled India in being able to commence the supply of SPF *L.vannamei* broodstock from its BMC located in Visakhapatnam and this year about 30,000 broodstock were given to the commercial hatcheries. This has paved the way to decrease the pressure on import of broodstock as well as on quarantine space availability of AQF. RGCA foresaw the need of the shrimp farmers to procure quality SPF broodstock at a relatively lesser rate within the country, and initiated this project. The facility is capacitated to supply around 45,000 broodstock to the Industry each year.

Pioneering attempts were also made by RGCA in the technology front of Domestication of Tiger shrimp Project and other culture technology development flagship projects such as Mangrove Crab, Artemia, Cobia, Seabass, Scampi, Tilapia and Grouper. RGCA produced and supplied around 19 million high health tiger shrimp seeds through its Tiger Shrimp Project. Our relentless efforts helped us to start propagation of tilapia culture in India by supplying all male GIFT tilapia seeds to the Government owned bodies of various states initially.

The year 2013-14, also witnessed the expansion of the quarantine infrastructure of the Aquatic Quarantine Facility, to 20 cubicles, in tune with the increased momentum of *vannamei* culture in India. The implemented facility of online quarantine space reservation for the benefit of quarantining the imported *vannamei* broodstock consignments of the stakeholder is functioning smoothly. The AQF continues to play its pivotal role in mitigating the disease spread associated with the introduction of *L. vannamei* import to India with a seamless quarantine survival of 96.67 %.

The Technology Transfer Training division of RGCA was also successful in fulfilling the Institute's mandate, by conducting a host of outreach and training programmes, including seminars, workshops, on farm-site demonstration trainings etc. The library services also enhanced resources by adding the latest available books and by subscribing to reputed International journals.

RGCA has shown its respect to the man, Dr E G Silas - the guiding force behind its success by honoring him through organizing an Endowment lecture for which world renowned scientific community in the field were invited.

The year 2013-14 also recorded remarkable breakthrough in the field of taxonomical research and population studies in mangrove crabs by the Central Aquaculture Genetics Lab (CAGL) team. The researchers of the CAGL resolved the much long taxonomical ambiguity of the mangrove crab species in India using multiple genetic markers and concluded that only two species of genus *Scylla* commonly available in Indian waters.

Finally, I acknowledge the commendable achievements made in all the projects of RGCA and are reported in the achievements briefed under each project heads of the annual report. While presenting the annual report for the year 2013-14, I have the privilege of acknowledging the unstinted support of the Scientific Advisory Committee and the Executive Committee of RGCA and the commitments shown by the RGCA team for their performance in various project activities. I also thank the Hon'ble Minister of Commerce & Industry, and other senior officials of the Ministry of Commerce & Industry for providing all support to RGCA for all its endeavours.

In summary, 2013-14 that marks completion of 18 years of this Organization, saw the Institute march forward confidently in accordance with its mission.

Leena Nair. IAS  
Chairman MPEDA & President RGCA

29<sup>th</sup> September 2014

# RGCA at a Glance

Rajiv Gandhi Centre for Aquaculture (RGCA) is the Research and Development arm of the Marine Products Export Development Authority (MPEDA), Ministry of Commerce and Industry, Government of India and has been implementing the plan schemes of MPEDA under the head Research & Development. RGCA is functioning as a society, registered under Tamil Nadu societies Registration Act, 1975 since January 5<sup>th</sup> 1996. RGCA has established its Headquarters at Sirkali, Nagapattinam District, Tamil Nadu.

Rajiv Gandhi Centre for Aquaculture is actively involved in the development of various sustainable aquaculture technologies that are bio-secure, eco-friendly and traceable for seed production and grow out farming of various aquatic species, those having export potential in particular. RGCA has also developed a state-of-the-art Technology Transfer and Training centre for disseminating the technologies developed at the various projects established at different locations in the country to promote the aquaculture industry in India. The various projects of RGCA were implemented with a budget outlay of Rs. 133 crores during the 11<sup>th</sup> plan period. A budget outlay of Rs. 297 crores has been proposed for the ongoing projects and two new projects during the 12<sup>th</sup> Plan period.

RGCA is governed by an Executive Committee comprising of members from offices of the MPEDA, MoC & I, ICAR, DBT, Commissioner of Fisheries from the states of Andhra Pradesh, Tamil Nadu & Gujarat; Director of Fisheries of Kerala, Tamil Nadu, Andaman & Nicobar Islands and the U.T of Pondicherry. Chairman MPEDA is the President RGCA. Presently Ms. Leena Nair, IAS, is President RGCA and the Chairman of its Executive Committee. The members of the Executive Committee are:

- ❖ Ms. Leena Nair, IAS, Chairman, MPEDA
- ❖ Shri. M. C. Luther, Director (EP&MP), MoC&I
- ❖ Dr. (Mrs) B. Meenakumari, DDG (Fy), ICAR, New Delhi
- ❖ Dr. A.S. Ninawe, Sr. Advisor, DBT, Ministry of Science & Technology, New Delhi

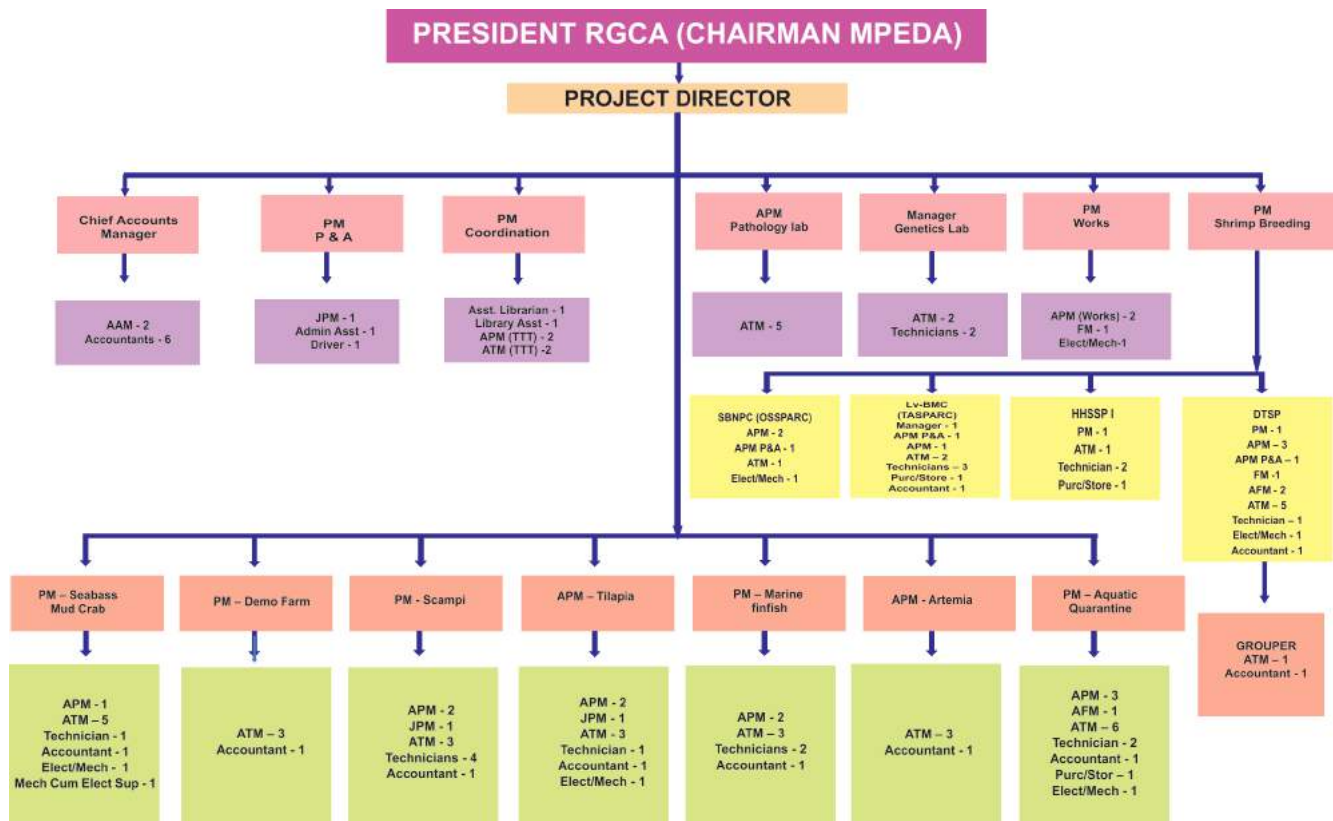
- ❖ Dr. A.G. Ponniah, Director CIBA, Chennai
- ❖ Shri. K. Praveen Kumar, Commissioner of Fisheries, Andhra Pradesh
- ❖ Shri. C. Munianathan, IAS, Director/Commissioner of Fisheries, Chennai
- ❖ Shri. J. Chandrasekhar, Director of Fisheries, Dept. of Fisheries, A&N Islands
- ❖ Smt. Noorjahan Beevi, Joint Director (Inland Fisheries),  
Dept.of Fisheries, Chennai
- ❖ Smt. B. Remadevi, Executive Director, ADAK, Kerala
- ❖ Smt. Mary Chinnarani, Director, Dept. of Fisheries & Welfare, Pondicherry
- ❖ Shri. N. Ramesh, ITS, Director (Mktg), MPEDA
- ❖ Shri. B. Sreekumar, Secretary, MPEDA
- ❖ Shri. Y. C. Thampi Sam Raj, Project Director (I/c), RGCA
- ❖ Smt. E. V. Deepa, CEO, MPEDA, Kerala
- ❖ Shri. P. L Darbar, Commissioner of Fisheries, Gujarat
- ❖ Shri. P. Mohanasundaram, Director, MPEDA

The Technical/Scientific programmes involved in implementing various projects of RGCA are conceptualized and finalized by a Scientific Advisory Committee comprising of senior level scientists of the country. Dr. E.G. Silas, former Vice Chancellor, Kerala Agricultural University and former Director, CMFRI is the present chairman of this committee.

The members of the Scientific Advisory Committee of RGCA are:

- ❖ Dr. B. Meenakumari, DDG (Fisheries), ICAR, New Delhi
- ❖ Dr. M.V. Gupta, Former ADG, World Fish Centre, Penang, Malaysia
- ❖ Dr. George John, Senior Advisor, DBT, New Delhi
- ❖ Dr. T.C. Santiago, Retd. Principal Scientist, CIBA, Chennai
- ❖ Dr. R.S. Biradar, Joint Director, CIFE, Mumbai
- ❖ Dr. T. Balasubramanian, Dean & Director, CAS Marine Biology, Parangipettai
- ❖ Dr. A. Gopalakrishnan, Principal Scientist, NBFGR Kochi Unit
- ❖ Ms. Leena Nair, IAS, President, RGCA – Ex-officio member
- ❖ Shri. P. Mohanasundaram, Director, MPEDA - Ex-officio member
- ❖ Shri. Y.C. Thampi Sam Raj, Project Director, RGCA – Ex-officio member

# Organizational Structure



PM - Project Manager, APM - Assistant Project Manager, JPM - Junior Project Manager  
 FM - Facility Manager, AFM - Assistant Facility Manger, ATM - Assistant Technical Manager  
 AAM - Assistant Accounts Manager



# Mission Statement

- ❖ To promote sustainable aquaculture with long term vision
- ❖ To function on no profit no loss basis for research & development activities relevant to its objectives
- ❖ To establish Technology Development Centres in Aquaculture in various locations in India for developing and disseminating appropriate technologies for scientific aquaculture
- ❖ To develop and introduce world class sustainable technologies in aquaculture
- ❖ To transfer technical know-how, plans, designs and other relevant information for establishing aquaculture units in various states of India
- ❖ To give consultancy and technical services to the entrepreneurs and farmers for establishing aquaculture units
- ❖ To impart training in various aquaculture technologies developed at its centres
- ❖ To conduct pilot scale operations and to set up demonstration farms to popularize the technologies developed/acquired
- ❖ To scale up the technologies developed in Research Institutes by joining hands with the concerned scientists and disseminate the same through extension, education and demonstration programmes
- ❖ To assist National Institutes, agencies both in public as well as in private sectors for developing innovative technologies which are having scientific application
- ❖ To undertake execution of aquaculture projects entrusted by Government agencies/ departments like Department of Bio-Technology (DBT), Department of Earth Sciences, Ministry of Agriculture, Ministry of Commerce, Ministry of Food Processing etc
- ❖ To take up such activities as to re-seed and replenish the over exploited stock of the sea and other large in land water bodies through ranching with hatchery reared young ones for sustainable development of fisheries
- ❖ To introduce proven aquaculture technology of the selected species which are commercially successful elsewhere in the world but not yet introduced in India. The centre will buy the technology from national or international source, blend the same under Indian condition with local technology if available and sell the same to Indian entrepreneurs after assuring the commercial viability

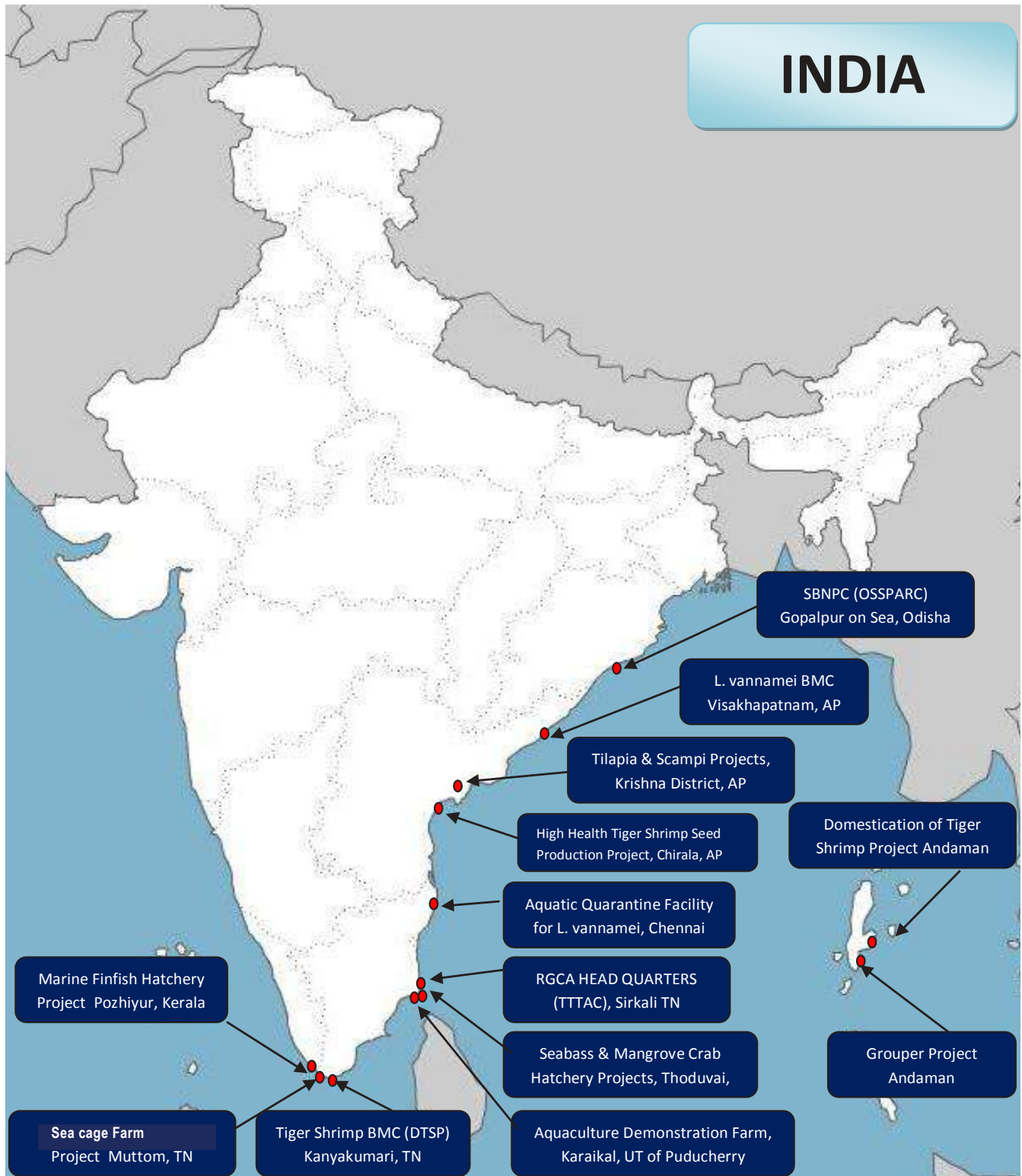
# Ongoing Projects & their Locations

RGCA operates 12 important aquaculture projects spread over 18 different species specific locations across the country. They are;

- ❖ **Seabass Hatchery Project**  
Thoduvai, Nagappattinam District, Tamil Nadu
- ❖ **Mangrove Crab Hatchery Project**  
Thoduvai, Nagappattinam District, Tamil Nadu
- ❖ **Aquaculture Demonstration Farm**
  1. Karaikal, UT of Puducherry
  2. Mahendrapalli, Nagappattinam Dt. Tamil Nadu
- ❖ **Domestication of Tiger Shrimp Project(DTSP)**
  1. Amkunj, Middle Andamans,
  2. Kodiaghat, South Andamans,
  3. Kanyakumari, Tamil Nadu
  4. Pilot Scale Broodstock Multiplication Centre (OSSPARC), Gopalpur on sea, Odisha
  5. High Health Tiger Shrimp Seed Production Unit Chirala, Andhra Pradesh
- ❖ **Scampi Broodstock Development Project**
  1. Kankipadu, Krishna District, Andhra Pradesh
  2. Manikonda, Krishna District, Andhra Pradesh
- ❖ **Artemia Project**  
Tharuvaikulam, Tuticorin, Tamil Nadu
- ❖ **Broodstock Multiplication Centre for *L.vannamei***  
(TASPARC : The Andhra Pradesh Shrimp Seed Production, Supply and Research Centre), Vishakhapatnam in Andhra Pradesh
- ❖ **Tilapia Project**  
Manikonda, Krishna District, Andhra Pradesh
- ❖ **Pilot Scale Marine Finfish Project**
  1. Pozhiyur, Thiruvananthapuram, Kerala
  2. Muttom, Kanyakumari district, Tamil Nadu
- ❖ **Grouper Project**
  1. Kodiaghat, South Andamans
  2. Sea area of Rutland Island, South Andamans
- ❖ **Technology Transfer Training and Administrative Complex**  
Sirkali, Nagapattinam District, Tamil Nadu.  
The Head Quarters of RGCA functions from this complex
- ❖ **Aquatic Quarantine Facility(AQF) for *L.vannamei***  
Neelankarai, Chennai, TamilNadu.

(Full addresses of the above locations, please see page 102)

# RGCA Project Locations





All-male Tilapia fry in nursery hapas being fed



# Executive Summary

Rajiv Gandhi Centre for Aquaculture (RGCA) devoted serious and sustained efforts in applied research and development of sustainable and ecofriendly technologies relevant to the aquaculture industry through its 12 important research projects spread over 18 different species specific locations across the country. The achievements of the organization during 2013-14 is summarized in the ensuing report.

- ❖ RGCA has made significant achievement in year round seed production of Asian Seabass (*Lates calcarifer*) during the year. The project facility located at Thoduvai, Nagapattinam District, Tamil Nadu doubled its production over the previous year by supplying over 9.91 lakhs of seeds (fry & fingerlings) to various beneficiaries including farmers, NGO bodies, Fisheries Departments and Research Institutions, during the period under report.
- ❖ An exclusive Mangrove Crab Hatchery Facility with a capacity of over one million crab instars per annum was established by RGCA at Thoduvai, Nagapattinam, Tamil Nadu. This state of the art facility was the first of its kind in India and was dedicated to Nation on 9<sup>th</sup> April 2013. During the period under report, the hatchery produced over 8 lakhs crab instars and accomplished a highest survival of 13% for seed production. The facility supplied over 2.7 lakh crab instars to farmers from Tamil Nadu, Andhra Pradesh, Orissa, Kerala and Maharashtra while around 3.9 lakh instars were stocked in the RGCA demonstration farm at Karaikal for nursery rearing purpose. Crablets produced from the in house demonstration farm and crab instars from the hatchery were much sought by crab farmers and also by Fisheries Research Institutions for their experimental studies.

- ❖ The Domestication of Tiger Shrimp Project (DTSP) established and operationalized a state-of-the-art Nucleus Breeding Centre (NBC) for *Penaeus monodon* at Andamans and dedicated it to the Nation on 28<sup>th</sup> February 2014. About Nine founder families were being maintained at NBC for the production of G2 families. Concurrently, the project also initiated the creation of a Broodstock Multiplication Centre (BMC) of Specific Pathogen Free (SPF) tiger shrimps at Kanyakumari, Tamil Nadu.
- ❖ Further, the DTSP also established a second unit of High Health Tiger Shrimp Seed Production (HHSSP) at Chirala, Andhra Pradesh, besides its first unit at OSSPARC, Odisha so as to ensure regular supply of sufficient quantity of high health monodon seeds to the shrimp farmers. This unit produced a total of 9.36 million seeds from 11.941 million of nauplii received from NBC, with a fairly good survival of 78.7%. These seeds were supplied to 57 farmers of Orissa, Andhra Pradesh, Gujarat and Maharashtra and MPEDA demonstrations. In addition to this, the DTSP also produced and supplied 15.04 million seeds to the farmers of Odisha, Andhra Pradesh, Gujarat and Maharashtra from its first unit at OSSPARC.
- ❖ The Scampi (*Macrobrachium rosenbergii*) Broodstock Development Project with its hatchery facility at Kankipadu Mandal, and its experimental farm at Manikonda Village, Andhra Pradesh achieved an excellent survival (80 %) in the post larvae subjected to microsurgical ablation for the production of neofemales. In order to accelerate the mass scale production of neofemales, the research team of the project initiated a study on the development of molecular sex markers for the Indian strains of scampi involving the use of Amplified Fragment Length Polymorphism (AFLP) method, involving radioactive <sup>32</sup>P labelled ATP (Adenosine tri-phosphate).
- ❖ The Artemia project at Tharuvaikulam continued demonstration of Artemia cyst and Biomass

production through aquaculture. A steady growth in the production of cyst production per unit area was achieved. The project registered a production of 71.063kg of dry cysts and sales of 63.100 kg dry cysts in the period under review. A 10 ha site was also identified by the project in Ramanathapuram District, Tamil Nadu for the establishment of a New Demonstration Farm for Artemia production

- ❖ The Project on Broodstock Multiplication Centre (BMC) for *L. vannamei* (Pacific White Shrimp) pursued broodstock production in collaboration with M/s. Oceanic Institute (OI), Hawaii and commenced supply of broodstock during the year. The facility produced and supplied 34,500 SPF Broodstock to the approved *L. vannamei* hatcheries across the country in 81 consignments during the year. In addition, the project also successfully evaluated the performance of several families of *L. vannamei* from the M/s. OI, Hawaii for performance in Indian conditions.
- ❖ The Tilapia Project at Manikonda Village, continued mass production trials for all-male GIFT seed and supplied to several Fisheries Departments, Universities in Tamil Nadu, Maharashtra and Kerala for their field trials and demonstrations. The project successfully standardized all-male seed production protocols and accomplished production of over 3 million all-male Tilapia seeds during the period under report. The project also succeeded in the mating of G2 GIFT stocks for the production of 41 families of G3 GIFT stocks during the period under review in the Selective Breeding Programme.
- ❖ The Marine Finfish Hatchery Project at Pozhiyur, achieved year round Cobia Breeding and Seed production and obtained eight successful spawnings during the year. The Facility produced 32,000 Cobia fingerlings (4-10 cms size) during the period under report and supplied 16,095 nos of fingerlings to farmers and Research Institutions. Around 36.3 metric tons of market sized cobia were also produced

as a part of its sea cage farming demonstrations at Muttom in Tamil Nadu.

- ❖ The Grouper project has succeeded in Breeding orange spotted Grouper and rearing the larvae to fingerlings. Cage culture of the hatchery produced larvae is being carried out. The Andaman Administration have allocated 2 acres of land to RGCA for the establishment of a Multi-species Grouper Hatchery Project of RGCA. The National Institute of Ocean Technology, Andaman Centre is carrying out the EIA study.
- ❖ The Technology Transfer and Training Centre also efficiently played its role in technology dissemination to the farming community of the Nation. The centre conducted a series of training, workshops and familiarization programmes on various aquaculture topics on which RGCA had proven technologies such as mangrove crab culture & seabass husbandry practices on Asian seabass culture, Aquaculture practices etc., besides organizing field trips to RGCA hatcheries and demo farms so as to offer hands on training to the participants. ISMAF 2013– An International Seminar-workshop on Mud crab Aquaculture and Fisheries Management and EGSEL–2013; Dr. E.G. Silas Endowment Lecture organized by the centre at Sirkali won national and international acclaim and appreciation. A one day workshop on “Crisis management to contain spread of EMS in shrimp farms/hatcheries” was also organized by the Centre, on the symptoms of EMS disease, the

etiological agent and preventive measures.

- ❖ The Central Aquaculture Genetics Laboratory (CAGL) supported all the selective breeding programmes pursued by various projects of RGCA. The lab also conducted population genetic studies for targeted species using advance molecular markers to determine founder population for selective breeding programme. CAGL resolved the taxonomic ambiguity of mangrove mudcrab for the first time in India and scientific manuscripts with regard to the same have been accepted for publication by reputed international journals. The Genetics lab has its credit of 37 published unique sequences for mangrove mud crabs *Scylla serrata* and *Scylla olivacea* which are hosted in the public domain with GenBank.
- ❖ The Central Aquaculture Pathology Laboratory (CAPL) of RGCA continued to serve for the industry by offering its quality diagnostic services. The lab screened 1882 samples and conducted 11,566 PCR tests, during the report under review and made remarkable progress in the detection of AHPND through histology studies.
- ❖ The Aquatic Quarantine Facility (AQF) for *L. vannamei* at Neelankarai, Chennai, received further fillip during the period under review through the addition of 13 quarantine cubicles, thus boosting its quarantine capacity to 20 cubicles. The facility continued to deliver its quality quarantine services to the industry with a quarantine survival of 98.21%.



*Tilapia: Individual mating hapas set up at the farm in Manikonda, AP for GIFT selective breeding operations*





# R & D Project Highlights



Harvested Asian Seabass, *Lates calcarifer*



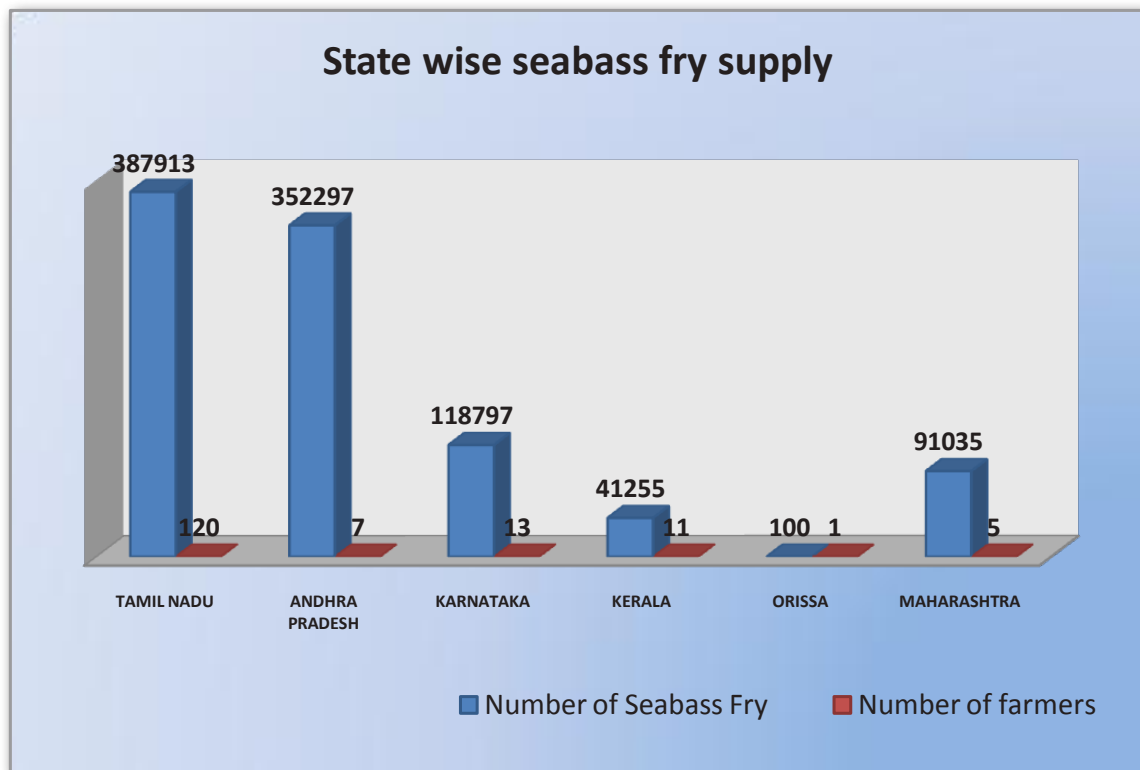
Seabass fry produced at the hatchery

# Seabass Hatchery Project

The Seabass hatchery project of RGCA is located at Thoduvai, Nagapattinam District, Tamil Nadu. The hatchery has a dedicated state-of-the-art infrastructure, equipped with RAS (Recirculation Aquaculture Systems) with thermo and photo controls for year round production of Seabass seeds. The hatchery produces and supplies fry and fingerlings of Asian Seabass, through out the year.

## Activities & Accomplishments

The Seabass Hatchery substantially scaled up seed production during the year 2013-2014. A total of 9.91 lakhs of Seabass seeds (fry & fingerlings) were supplied to farmers, NGOs, MPEDA & RGCA Demonstration programmes, Fisheries Research Institutions and Fisheries Departments. This is almost double the production of 4.9 lakhs achieved during the previous year.



Quantity of seeds (in nos.) supplied from RGCA hatchery



Seabass broodstock



Broodstock housing tank with RAS

The summary of activities at the project such as brood stock collection, Quarantine and husbandry as well as seed production and survival is detailed below:

### Broodstock Collection & Quarantine

During the year, 22 new Seabass broodstock were collected from wild and added to the stock in the hatchery after quarantine treatment. This included 12 fish brought from Kerala as an initial step towards obtaining genetically diverse stocks to initiate selective breeding in seabass. A total 50 fishes were maintained in broodstock housing tanks supported with Recirculation Aquaculture Systems (RAS).

### Breeding and Seed Production

The Seabass spawned successfully in Recirculation Aquaculture System (RAS) installed at the hatchery. On periodical cannular biopsy of the broodstock, seven successful spawnings were obtained. 5.61 million hatchlings obtained from 7 batches were stocked in larval rearing tanks. The larvae were reared to fingerlings and around 9.91 lakhs fry/fingerlings (R & D produce) were supplied to farmers, NGOs, MPEDA & RGCA Demonstration programmes, Fisheries Research Institutions, ICAR organizations and Fisheries Departments to popularize seabass farming in the country.

No. of Spawning conducted during 2013-14	7
No. of Hatchlings stocked	5.61 million
No. of Seeds (Fry/Fingerlings) supplied	9,91,397 nos

Spawning and seed production during 2013 - 14



Seabass hatchery at Thoduvi, TN



Asian Seabass, *Lates calcarifer*

Year	Farmers		ICAR - Research Institutes (CMFRI)	M/s Auromaritech	Other Research Institutes	MFDC, Maharashtra	Fisheries Departments
	No. of farmers	Qty. of Seed supplied					
2013-14	145	698581	30668	200024	17963	21115	23046
<b>Total number of seeds supplied</b>						<b>9,91,397</b>	

Seed supply from the hatchery to various farmers / organization during 2013-14

#### Infrastructure additions during the year

Installation of additional infrastructure facilities such as ozonisers, oxygen generators, UV filtration systems etc were necessitated following the establishment of a Commercial Fish Meal plant in close proximity to the Seabass hatchery of RGCA. Inconsistency in water quality was overcome by the installation of the above facilities. This also enabled the facility to enhance the seed production from 5.19 lakhs nos. during 2012-13 to 9.91 lakhs during the current year.



Categories of Seabass fry buyers from the RGCA Hatchery during 2013-14



UV filtration systems



Oxygen Generators



Ozonisers



Embryonic development in Mangrove Crab eggs

# Mangrove Crab Hatchery Project

The pilot scale Mangrove Crab Hatchery Project of RGCA at Thoduvai was initiated in 2004 when indiscriminate exploitation of natural mangrove crab resources had an impact on the fishery in several parts of the country. Development of technologies for hatchery seed production of mangrove crab and grow out farming were initiated for diversification of aquaculture with this species. In an encouraging development during the period under review, several farmers in Tamil Nadu, Andhra Pradesh, Orissa, Kerala, Karnataka, West Bengal and Maharashtra have initiated the stocking of crab instars in aquaculture ponds, either as monoculture or as polyculture with shrimps. This has resulted in an increased demand for crab instars and increased sales from the hatchery. Crablets from the Demonstration farm and crab instars from the hatchery are also sourced by other research institutions for their experimental studies.

## Activities & Accomplishments

### India's First and Exclusive Mangrove Crab Hatchery

RGCA developed a state of the art exclusive Mangrove Crab Hatchery with a capacity for the

production of over one million crab instar per annum at Thoduvai in the Seabass Hatchery premises and commenced trial production during the year.

This hatchery was formally inaugurated on the 9<sup>th</sup> April 2013 by Dr. B. Meenakumari, Deputy Director General (Fy), ICAR, at Thoduvai Nagapattinam District, Tamil Nadu in the presence of Ms. Leena Nair, IAS, Chairman MPEDA, Dr. E. G. Silas, Chairman, SAC of RGCA and Shri. P. Mohanasundaram, Director, MPEDA.

Details of Broodstock collection, quarantine, spawning, seed production and sale, for the period under review are furnished below:

### Collection and Quarantine of Matured crabs

Both farm reared and wild caught matured crabs were used for production. Around 117 crabs in the size range of 550 to 1000 gms were sourced from farming areas as well as from the wild and quarantined at the facility. The crabs were screened for White Spot Syndrome Virus (WSSV) and only those free of WSSV were stocked in broodstock holding tanks. Healthy broodstock were then selected for spawning.



Mangrove crab hatchery located at Thoduvai, Nagapattinam - Dist.



Inauguration of mangrove crab hatchery by Dr. B. Meenakumari, Deputy Director General (Fy), ICAR, at Thoduvai, Nagapattinam District, Tamil Nadu in the presence of Ms. Leena Nair, IAS, Chairman MPEDA, Dr. E. G. Silas, Chairman, SAC of RGCA and Dr. Emilia Quintio, Scientist, SEAFDEC, Philippines on 09<sup>th</sup> April 2013

### Spawning and Hatching

Around 103 nos of Broodstock (including 2 nos of berried crabs) that passed the quarantine were maintained in broodstock holding tanks at the hatchery. These crabs along with 14 nos collected during the previous year were used for seed production.

From the above, around 89 crabs spawned in captivity out of which 72 successful hatchings were obtained which yielded 161 million Zoeae. Around 23 million healthy zoeae were stocked in the tanks for larval rearing while the remaining 138 million zoeae were ranched into the estuarine area and open sea close to the hatchery.

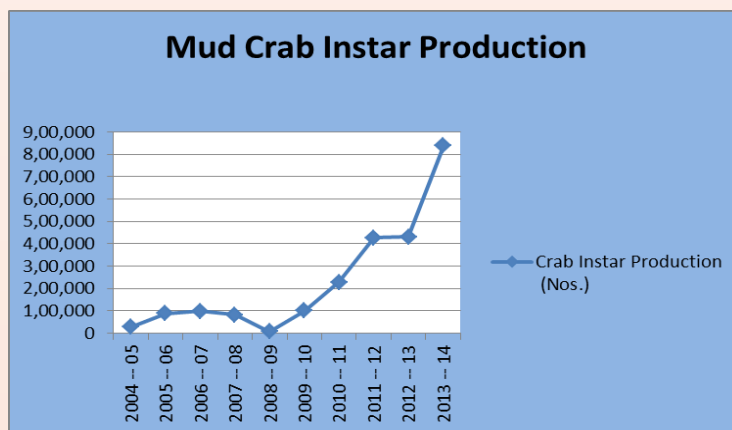
### Seed Production

27 seed production cycles were carried out during the year through which around 8.37 lakhs crab instar (crab seed) in the size range of 0.4-0.6 cm were produced. Production of crab instar doubled during

2013-14 over the previous year. The increasing trend in production indicates the success in standardization of technology for seed production through the adoption of green water system and use of probiotics in larval rearing. The maximum survival rate achieved in larval rearing (from zoea to crab instar) during the year was 13%. The steady increase in survival rates over the years provides ample scope for viable commercialization of crab hatchery seed production. Details of crab instar production at the RGCA Mangrove crab hatchery facility over the years is shown in the table below.

### Promotional Supply of Crab instar

Out of the 8.37 Lakhs crab instar produced as R & D output during the year, around 2.71 lakhs were supplied to farmers from Tamil Nadu, Andhra Pradesh, Orissa, Kerala and Maharashtra while 3.86 Lakhs were stocked in nursery hapas at the RGCA demonstration farm at Karaikal for rearing to crablets. Crablets from the demonstration farm were in turn supplied to farmers,



Year-wise seed production of mangrove mud crab instars



NGOs, MPEDA and RGCA demonstration programmes, Fisheries Research Institutions and to the Fisheries Departments of various states for commercial farming operations/ farming demonstrations.

### Additional Infrastructure Facilities

The following infrastructure was added to the mud crab hatchery during the year;

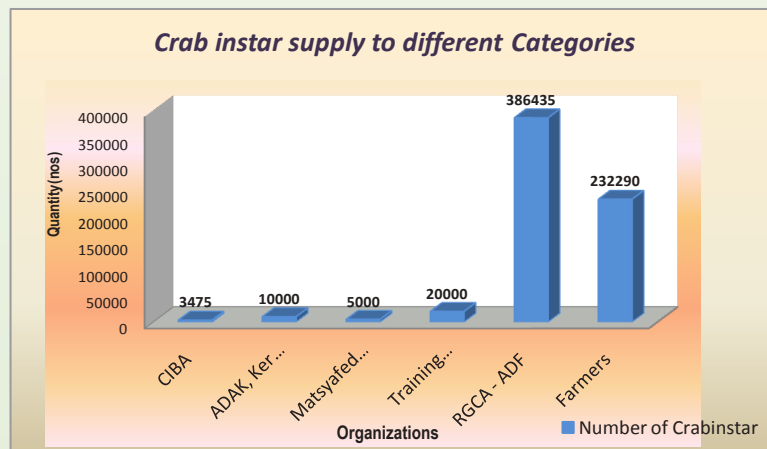
- ❖ UV filtration (10 ton/hour) unit for water treatment was installed for the purpose of culturing of algae, rotifer and larval rearing.
- ❖ CCTV Camera surveillance was provided for monitoring activities in mangrove crab hatchery.



Berried crab (Gravid female)



CCTV Camera , UV filtration



Crab inster supply to different categories of buyers



Mangrove crab nursery rearing in hapas

# Aquaculture Demonstration Farm Project

The Aquaculture Demonstration Farm of RGCA is located at two separate sites. The first site having an extent of 10 acres of leased land developed during the year 2000 at Keezhoduthurai, Karukkalacherry Road, Karaikal in the Union Territory of Puducherry and the second site of 18.72 acres of own land on the banks of the Kollidam River at Mahendrapalli, Nagapattinam District Tamil Nadu is under development and ponds construction during the current year.

This project was taken up with a view to develop and demonstrate viable technologies in nursery rearing and grow-out farming of new species such as cage farming of Asian Seabass in earthen ponds, mangrove crab culture in the hapas, pens in ponds, open ponds and soft shell crab culture in box in open pond system etc.

## Activities & accomplishments

### Demonstration activities

Around 3.86 lakhs of crab instars were stocked in batches round the year in 625 nursery hapas at the demonstration farm. These were used for:

- ❖ Demonstration of technology for nursery rearing of hatchery produced crab instars to crablet (match box size) stage in nursery hapas in ponds.
- ❖ Demonstration of technology for farming of crablets initially in hapas with shelters, and later in grow-out pens in ponds or open ponds.
- ❖ Juveniles of 75g and above were also stocked in soft shell crab production boxes to study the molt frequency and weight gains in different size groups of juvenile crabs



Satellite view of Aquaculture Demo Farm

- ❖ Demonstration of soft-shell crab production was also carried out in crab boxes in ponds with around 4700 juveniles of various size groups produced from hatchery produced crab seeds.

### Promotional supply of crablets

A total of 1.51 lakhs crablets were produced during the year at survival rates ranging between 34% – 52%. While 61000 crablets were supplied from the project to 20 farmers across the country, around 23000



Seabass cage farming

crablets were supplied to the Fisher folk of Maharashtra for mangrove crab stock enhancement and ecofriendly aquaculture development under a UNDP programme in mangrove areas with technical assistance from RGCA. Another 11500 nos of crablets were supplied to three centers of MPEDA for crab culture demonstrations and the remaining 6500 nos. were supplied to other Govt. Institutions for their demonstrations.

### **Stock Enhancement Programme of Mangrove Crab by farming in pens in mangrove areas in Sindhudurg, Maharashtra**

The Aquaculture Demonstration farm of RGCA provided technical expertise for conducting detailed survey in 7 villages in 3 taluks of Sindhudurg District, Maharashtra under GOI – UNDP programme under Department of Forest, Mangrove Cell, Government of Maharashtra implemented through NETFISH and Regional Centre, MPEDA, Panvel and identified suitable

sites for construction of pens in mangrove areas. The fisher folk of the area were sensitized and motivated to create awareness and interest on mangrove crab farming, as part of stock enhancement programme for the first time in India.

Renovation of an abandoned tide fed farm having 3 ponds (1.4 ha area) in Hadi village and construction of 11 pens (1.0 ac. each) at five villages (Dev baug, Tarkarli, Rameshwar, Veerwadi and Vadathar) have been taken up. RGCA has supplied 22,680 nos of crab lets to these fisher folk and provided technical guidance for managing the pens and ponds.

Around 4700 Seabass fingerlings of size range 5 – 7 cms were also stocked in 14 cages to demonstrate cage culture of Asian Seabass in cages in ponds to trainees.





Release of crablets by ADG, MOEF in Hadi village



Tide fed farm at Hadi, Sindhudurg Dist.



Fisher group feeding mangrove crab at Devbaug



Crablets ready for stocking

Around 1.2 metric tons of Asian seabass in the size range of 500 gms to 1.1 Kg were harvested as a part of a grow-out farming demonstration in cages in ponds from the batch that was stocked during the previous year. The demonstration farm also carried out an experimental trial of Grouper and Cobia farming in cages in ponds during the year.

#### Development of culture site at Mahendrapalli

RGCA proposes to develop a multi-species aquaculture demonstration farm at this site where demonstration of different kinds of culture practices of different species of marine & brackishwater finfish, and crustaceans will be carried out. The design of the farm has been completed and construction activities initiated during the year. The site will have several small identical experimental ponds where scientific field level studies on various culture practices can be carried out.



Releasing crablet



Black Tiger Shrimp - *Penaeus monodon*

# Domestication of Tiger Shrimp Project

The Domestication of Tiger Shrimp Project has been established to provide high quality specific Pathogen Free (SPF) domesticated stocks of black tiger shrimp – *Penaeus monodon* to the shrimp aquaculture industry. The Nucleus Breeding Centre of this facility has been set up at Kodiaghat in South Andaman and the project has the following components:

- ❖ Pre-primary and Primary Quarantine Unit: Amkunj, Middle Andaman, A & N Islands
- ❖ Secondary Quarantine Unit: Kodiaghat, South Andaman, A & N Islands
- ❖ Nucleus Breeding Centre: Kodiaghat, South Andaman, A & N Islands
- ❖ Pilot Scale Broodstock Multiplication Centre at OSSPARC: Gopalpur on Sea, Orissa
- ❖ Tiger Shrimp Multiplication Centre: Thekkurichi village, Kanyakumari dt.TN.
- ❖ High Health Tiger Shrimp Seed Production Unit– Chirala, Andhra Pradesh

## Activities and Achievements

Details of activities and achievements at the various units of the project during the year 2013-14 are furnished below:

### Pre Primary and Primary quarantine Unit

This unit is established at Amkunj in Middle Andaman, A & N Islands close to a major shrimp brood stock landing centre. About 800 m<sup>2</sup> facility has been established by RGCA in Amkunj, for the production of SPF founder families. This facility consists of quarantine area, holding area, maturation tanks, spawning & hatching area, larval rearing and post larval rearing section, live feed section, a microbiology lab, ETS, back up diesel generators, pumps, blowers, filtration, disinfection systems, dormitory, kitchen, store etc.

Around 251 males and 269 females were screened and 48 males and 48 females were selected for the production of founder families during the year 2013-14. Thirty five founder families were produced during the year. However, seven of the same were discarded due to the presence of either SMV/IHHNV/IHGS. A total of 23 families were transferred to the Secondary Quarantine unit.

### Secondary Quarantine Unit

This unit is established at Kodiaghat in South Andaman A & N Islands in RGCA's own land with a



Equipment and machinery supporting culture systems in NBC

floor area of about 1100 m<sup>2</sup> world class facility with recirculation systems, modern seawater intake and filtration/disinfection systems and twelve number of 15 MT tanks with individual recirculation systems for superior biosecurity. This facility initiated operation since 2009 and at present is holding G1/Founder families.

During the year 2013-14 the Secondary quarantine unit maintained 11 founder families from first phase and 12 founder families from second phase along with 1 G3 family which was grown in this unit up to 40 gms size. These families were found to be negative for IHGS and hence they were transferred to the Nucleus Breeding Centre for further Breeding. Nine families from the above were shifted from NBC nursery unit to maturation for conditioning.

### Nucleus Breeding Centre

This is one of the largest facility having construction area of 8500 square meter consisting of maturation section comprising of maturation, spawning, hatching, larval rearing, micro algae, live feed production facilities, 8 grow out RCC raceways of 100 MT capacity each, laboratory, shower area, laboratory, sorting area, and machineries like large DG's, blowers, pumps, recirculation systems, filtration systems like rapid sand filter, cartridge filters, disinfection systems like ozonisers and UV sterilisers etc.

Nine founder families were shifted to maturation section for conditioning in order to produce G2. Artificial insemination procedure is being used for the production of G2 families.



Aerial View of the Domestication of Tiger Shrimp Project at Andaman



Broodstock holding tanks



View of the tank with Recirculation equipment at NBC

Grouper Hatchery at Rangachang, Andaman and the Broodstock Multiplication Centre for Tiger Shrimp at Kanyakumari Dt., Tamil Nadu via satellite link.

Shri. T.K.A. Nair, IAS, Advisor to the Prime Minister of India and former Chairman MPEDA, Lt. Governor of Andaman & Nicobar Islands, Lt. General A.K. Singh, Shri. Bishnu Pada Ray, Hon'ble Member of Parliament, Andaman & Nicobar Islands, Shri. Rajeev Kher, Commerce Secretary, Govt. of India, Shri. Anand Prakash, Chief Secretary, Andaman & Nicobar Islands



### Allocation of land for creation of additional facilities

The Andaman & Nicobar Administration allotted two acres (0.8 Ha) of land (bearing survey no. 255/205) contiguous to the RGCA NBC facility. This land would be the buffer zone around the NBC facility and would also be used for the development of a dormitory facility for the staff of the DTSP Nucleus Breeding Centre.

### Dedication of the NBC of DTSP to the Nation

The Nucleus Breeding Centre of the Domestication of Tiger Shrimp Project (DTSP) of RGCA/MPEDA at Andaman was dedicated to the Nation on Friday, the 28<sup>th</sup> February 2014 by Shri. Anand Sharma, Hon'ble Union Minister of Commerce & Industry, Govt. of India. On the same day, the Hon'ble Union Minister also laid the Foundation stone for the Multi-species

were the other important dignitaries who graced the function. Dr. E. G.Silas, Chairman, Scientific Advisory Committee of RGCA, was present at the project site in Kanyakumari along with other dignitaries including the Shri. Shankar Lal Kumawat, IAS, Sub Collector of Kanyakumari District during the function

### Pilot scale Multiplication Centre at OSSPARC

RGCA - SBNPC facility has two sections namely NBC and high health seed production section. Both the sections are independent from each other in all aspects and function separately with separate manpower.

### Pilot Scale NBC of the DTSP at OSSPARC

❖ Six G3 families and 3 G7 families are presently being maintained at the facility.

❖ Around 5.05 million High Health Tiger Shrimp seeds free from all OIE listed pathogens were produced at the facility from 25.96 million nauplii stocked. These seeds were supplied to farmers in the states of Odisha, Andhra Pradesh, Gujarat and Maharashtra.

### High Health Seed Production

The high health tiger shrimp seed production unit – II was established at Chirala, Andhra Pradesh at a leased out hatchery facility belonging to M/s. Sterling Shrimpex Pvt. Ltd. The facility was fully renovated and modified to meet the Biosecurity requirements for SPF seed production.

Renovation and modification works were completed in all the respective areas by second week of October 2013 and started algae production on third week of October 2013. During the first week of November 2013, the first batch of nauplii was received from NBC, South Andaman. Sale of post larvae was commenced from December 2013.

Seed production was carried out in three batches during the year and a total of 9 million seeds

were supplied to 57 farmers of Orissa, Andhra Pradesh, Gujarat and Maharashtra and MPEDA demonstrations from November 2013 to March 2014.

Nauplii stocked at the facility	- 11.941 Million
Post larvae production & supplied	- 9.36 Million
Survival (%)	- 78.70%

### Tiger Shrimp Broodstock Multiplication Centre

A Tiger Shrimp Broodstock Multiplication Facility is being developed at Thekkurichi village, Kanyakumari district, Tamil Nadu for large scale production and supply of selectively bred specific pathogen free tiger shrimp broodstock and nauplii for supply to shrimp hatcheries across the country for seed production and supply to farmers. This facility is being developed at 13.24.0 ha (32 acres) piece of land allotted by Government of Tamil Nadu to RGCA for the purpose. Conceptual design for the facility was completed and the site cleared of trees and other vegetation and fully fenced to commence the construction of the facility.

CRZ clearance from Ministry of Environment & Forests has been obtained. The development of the facility will be taken up in the coming year.



Cubicles in secondary quarantine

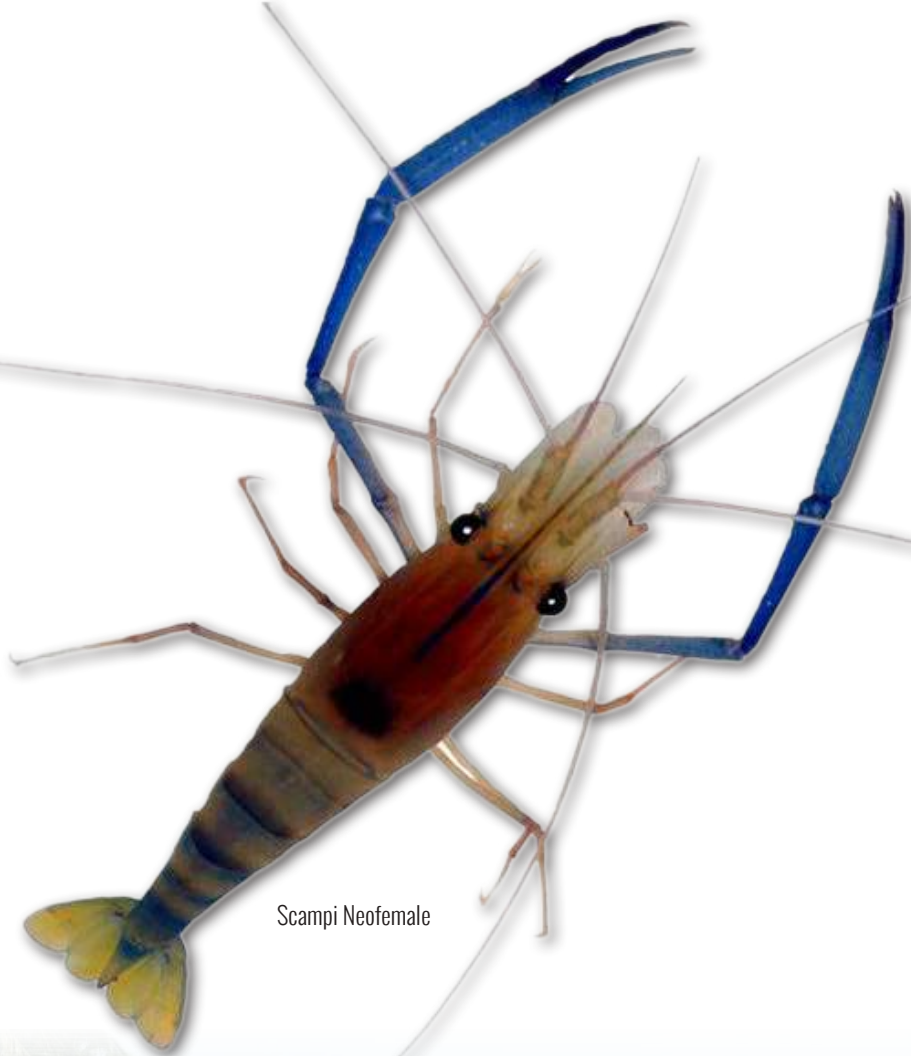




Nucleus Breeding Centre at OSSPARC



NBC Growout tanks at DTSP, Andaman



Scampi Neofemale





# Scampi Broodstock Development Project

The RGCA Scampi Broodstock Development Project comprises of a hatchery facility at Kankipadu and a grow-out & experimental farm at Manikonda, both in Krishna District of Andhra Pradesh. The main focus of this project is to improve the yields of *Macrobrachium rosenbergii* (Scampi) in the country through strain selection, monosex culture and selective breeding.

## Activities & Accomplishments

During the year under review, the hatchery succeeded in producing organic scampi seeds for the benefit of farmers, and the hatchery was credited with organic certification by INDOCERT, for the production and sales of organic scampi PL. The seeds produced were supplied to the farmers and the preliminary farm performance evaluation indicated good growth rate of the larvae. The Project also achieved fairly good survival (80 %) of the broodstock subjected to microsurgical ablation for the production of neo-females.

The details of various activities carried out at the project during 2013-14 are described below:

## Sex Reversal and Neo-female production

Segregation of males and microsurgical ablation of androgenic gland continued for sex reversal and production of Neofemales. Post-surgery survivals have been enhanced to around 80% during the year. Around 44 Neofemales (42 from Kerala and 2 from West Bengal) have been produced at the project during the year out of which the project presently maintained 27 survived ones (25 from Kerala and 2 from West Bengal). Mass scale Neofemale production is also being carried out by performing micro surgery in progeny of confirmed Neofemales of Kerala and West Bengal regions without sex determination/segregation at the ages between PL 15-25. These stocks are then directly stocked in earthen ponds and observed for the development of ovaries. 33 confirmed Neofemales have been obtained through this mass scale experiment in the Kerala region while confirmation of Neofemales from West Bengal in the mass scale experiment is awaited.

Details of segregations and surgeries carried out, completion of Quality Checks in stocks subject to

	Segregated males	Males survived after microsurgery	Animals stocked in farms after completion of QC	Suspected Neofemales sourced with ovary development	SNF's bred	Neofemale Progenies produced
Kerala	9134	6020	4981	1105	378	118
West Bengal	5492	3220	3012	169	40	23
<b>Total</b>	<b>14626</b>	<b>9240</b>	<b>7993</b>	<b>1274</b>	<b>418</b>	<b>141</b>

Neofemale production at the project during 2013-14

surgery, production of Suspected Neofemales, breeding and progeny production from these Suspected Neofemales are furnished in the table below. Progeny checks are being carried out from these batches for the confirmation of Neofemales.

### Mass scale Neofemale Production

In order to scale up neofemales numbers, all male progeny from confirmed neo females of Kerala and West Bengal regions are subjected to microsurgery without sex determination/segregation and after surgery at the ages between PL 15-25 is being carried out in earthen ponds without waiting for quality checks in hatchery.

In Kerala region, so far three mass scale experiments have been initiated and the project has been successful in breeding and stocking 75 batches of SNF progeny, 11 from the second and 12 batches from the third in earthen ponds at the farm. A total of 33 confirmed Neo females have been obtained in Kerala region in which, 20 Neo females from the first mass scale, 6 from the second and 1 from the third mass scale.

In West Bengal region, two mass scale experiments have been initiated in RGCA farm and they were stocked 1064 and 549 nos respectively. Presently, sourcing out of ovary developed females is underway from both the experiment. A total of 3 confirmed neo-females have been obtained in the West Bengal region.

In order to improve the success rate in segregation and surgery the experiment “to determine the optimum age and stocking density of PL to achieve maximum sex reversal” was repeated for the third time for both Kerala and WB regions.

### Selective Breeding Programme

The project initiated a selective breeding programme with Kerala and West Bengal strains. Over 30 females from each region were simultaneously bred, and the larvae produced were reared to postlarvae and stocked in 24 ponds (12 Kerala and 12 WB), with 1000 PLs in each pond. These were then grown to harvest sizes and prepared for harvest during April 2014. 20% of the best & largest animals harvested from each pond is proposed to be selected and re-stocked for individual PIT tagging to carry forward the selective breeding programme.

### Scampi seed supply

A total of 1.73 lakhs of organically produced mixed seeds to three farmers of Andhra Pradesh and 0.4 lakhs of all male seeds to Andhra and Kerala farmers as part of demonstration farming.

### Development of Molecular Sex Markers for Scampi

Early and accurate identification of sex of Indian scampi (*Macrobrachium rosenbergii*) is highly essential for



Berried Scampi Neofemales



Harvested All-male Scampi



Sand filter system and softner for hardness reduction

large scale Neofemale production. This can be achieved by the development of molecular markers for the Indian strains of Scampi involving the use of Amplified Fragment Length Polymorphism (AFLP) method, involving radioactive  $^{32}\text{P}$  labelled ATP (Adenosine tri-phosphate). To carry out this activity, RGCA has identified and tied up with the Kerala Agricultural University (KAU), which has a well-established Radiotracer Laboratory at College of Horticulture, Thrissur. It is proposed to initiate the works during early 2014-15.

### Infrastructure Development

#### Water treatment system

A state of the art water treatment system was installed in the hatchery which included slow sand beds, alkalinity reduction through acid dosing, softener for hardness reduction, rapid sand filtration, charcoal bed treatment, ultra filtration through cartridges and UV. Room heating system has been established with 12 nos of heavy duty room heaters.







Artemia Cyst

# Artemia Project

For the first time in India, RGCA had established an integrated Artemia production unit in 6.75 hectare area at Tharuvaikulam, Tuticorin in 2007. The objectives of the project were to develop and standardize the technology for good quality Artemia cyst and biomass production and to disseminate countrywide the Artemia culture technology to Coastal communities Self Help Groups and Entrepreneurs.

## Activities

### Preparation and inoculation of Artemia culture ponds

Algal production ponds were setup to produce sufficient amount of micro algae for feeding Artemia. Artemia culture ponds were inoculated with Artemia nauplii and algal water was pumped into the ponds. Saline water in the ponds was allowed to evaporate to obtain the required salinity. Optimum algal cell density and salinities were maintained throughout the culture period.

### Artemia dry cyst production

The wet cysts collected from the ponds were stored in brine for a minimum duration of 30-45 days. It was then washed using fresh water, dried using a spin dryer and then further dried in a fluidized bed dryer at 60°C for 6 hrs and packed in cans or pouches under vacuum nitrogen packing.

### Artemia Biomass Production

The adult artemia biomass were harvested from ponds, packed and frozen.

### Technology and Infrastructure development

Management practices were evolved to enhance cyst production. A new building was constructed with all accessories like air conditioner, ozone generator for the maintenance of algae stock culture. Experimental trials were carried out in current facility. A site having 10 hectare area was identified in Ramanathapuram District,

Year	Biomass prodn	Biomass supply	wet cyst prodn	Dry cyst prodn
2007-08	0	0	9	0
2008-09	37	9	26	0.7
2009-10	224	154	39	7
2010-11	1591	1678	32	19
2011-12	1522	1397	104	9
2012-13	793	693	190	66
2013-14	1312	1373	156	71
<b>Total</b>	<b>5480</b>	<b>5305</b>	<b>556</b>	<b>174</b>

Year wise production and supply of Artemia cyst and biomass

Tamil Nadu for establishing a new Artemia demonstration farm for commercial scale production. The land was leased from revenue department and fencing of the site was commenced.

### Accomplishments

#### Artemia cysts and biomass production

In the year 2013-14, 156 Kg of wet cyst were collected and dried. 21kg and 48kg of wet cyst collected during the year 2011-12 and 2012-13 respectively which have been kept for diapause, were also dried in the year 2013-14. After drying, a total amount of 71kg of dry cyst were obtained from 225kg of wet cyst. Around 1312 Kgs of Artemia Biomass was harvested during the

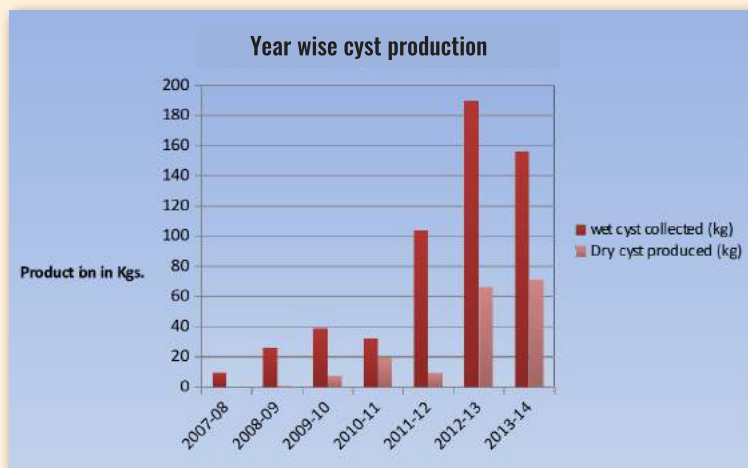
year while the total supply of frozen biomass was 1373 Kgs (including balance stocks from the previous years' production). The year wise production and supply of Artemia Biomass and production of Artemia cyst are detailed in table and figure.

#### Supply of Artemia cysts and Biomass

63 Kgs out of the 71 Kgs dry cyst production were supplied to shrimp hatcheries, Ornamental Fish Breeders and RGCA projects while the remaining stocks were retained for future inoculation. The harvested Artemia biomass were packed and frozen. A total 1372.5 kg of frozen Artemia biomass was supplied to Ornamental fish breeders, Shrimp hatcheries and finfish hatcheries. All batches harvested from the farm were screened and ensured to be free from WSSV (White spot syndrome virus) before being supplied to the buyers.

#### Feed Back

Excellent feedback was received from consumers with regard to hatching percentage and small size of Artemia nauplii obtained.



Year wise Artemia wet cyst and dry cyst production at the farm



Artemia Biomass packed, frozen and ready for supply





Pacific White Shrimp *L. vannamei*

# Broodstock Multiplication Centre for *L. vannamei*

RGCA established Broodstock Multiplication Centre for *L. vannamei* at Vishakhapatnam, Andhra Pradesh to provide consistent supply of high quality SPF Pacific White Shrimp (*L. vannamei*) broodstock to hatcheries in the country. The broodstock are selectively bred for good maturation performance, fast growth, disease resistance and high survival. High quality broodstock will thus enable hatcheries to produce and supply of high quality seeds to farmers. RGCA has tied up with M/s. Oceanic Institute, Hawaii, pioneers in the domestication of *L. vannamei* to implement this program. This facility started operating in September 2012 and supply of high quality *vannamei* broodstock commenced in April 2013.

The TASPARG (The Andhra Pradesh Shrimp Seed Production, Supply and Research Centre) of MPEDA at Vishakhapatnam in Andhra Pradesh was modified for the development of this facility. The total operation is being carried out in two phases, viz. Phase – I & II:

## Infrastructure

- ❖ Facilities for Phase – I Rearing: 20 tanks for the rearing of PL-15 to 15 gm size shrimps (10 tanks each of 15 sq. m & 27 sq. m).

- ❖ Facilities for Phase – II Rearing: 20 tanks for the rearing of 15 gm shrimps to brooders (4 tanks of 27 sq. m & 16 tanks of 40 sq. m each).

In addition, the centre has a complete seawater in take and treatment system comprising of pumps, reservoirs, ozone generating units, UV filters, cartridge filters, sand filters, algal production area, re-circulation units, seawater chiller units, power back-up systems, aeration systems and bio-security systems.

## Activities and Achievements

The Post Larvae (PL) were obtained from M/s. Oceanic Institute Hawaii and reared as per the Standard Operating Protocol prepared in association with M/s. Oceanic Institute, Hawaii. The resultant broodstock were subject to a strict screening process before being supplied to hatcheries. The RGCA plans to receive two batches of PLs every year. The facility has capacity to supply around 45,000 broodstock to the hatcheries every year. During 2013-14, the facility received around 67,000 post larvae from the Germplasm Stream in 4 batches, which were reared to broodstock sizes. Around 17,230 SPF broodstock were produced and supplied in 81 batches to the approved *L. vannamei* hatcheries across the country

## Production Details

During the above period, the centre received 75,747 PLs / Juveniles in Six batches. A total of 67,078 PLs (4 batches) were under Germplasm Stream (GS) and 8,669 Juveniles (2 batches) were under Evaluation Stream (ES). GS-Stock is meant for the production of SPF *L. vannamei* broodstock and ES is for field Study.



→ *L. vannamei* broodstock and larvae rearing tanks

As on 31.03.2014, the centre has produced and distributed 17,230 pairs to approved *L. vannamei* hatcheries. The details are as follows:

No	SIP Details			Dates		Type of Stock	Numbers Imported	Quantity Received at Lv-MC, Vizag
	SIP No	Date of Issue	Qty. Permitted	Arl: @ AQF, Chennai	Arl: @ Lv-MC site			
1	0402/2013/DADF	26.03.13	35,000 PL	30.03.13	04.04.13	GS - 2	35,000	33,200
2		“	5,000 Jvnl	08.04.13	13.04.13	ES - 2	5,000	4,885
3	1113/2013/DADF	16.08.13	35,000 PL	23.08.13	27.08.13	GS - 3	35,000	28,788
4		“	5,000 Jvnl	27.08.13	31.08.13	ES - 3	5,000	3,784
5	1561/2013/DADF	27.11.13	30,000 PL	28.11.13	04.12.13	GS - 4	24,000	1,890
6				17.01.14	22.01.14	GS - 4	5,000	3,200

Germplasm receipt details at the Lv BMC

Germplasm Stream No.	No. of hatcheries to which RGCA Broodstock supplied	No. of broodstock supplied
GS-1	32	8875
GS-2	22	6285
GS-3	8	2070
	81	17230

Details of Broodstock supplied from RGCA Lv Multiplication Centre





Filtration & seawater treatment equipment



Algal culture unit



Packing section



*L. vannamei* broodstock and larval rearing tanks (inside view)





Harvested GIFT Tilapia

# Tilapia Project

The Tilapia project of RGCA is based at Manikonda Village, Krishna District, Andhra Pradesh. This project has been established to develop and disseminate technologies for breeding and seed production of all male tilapia and also established a Nucleus Breeding Centre of the Genetically Improved Farmed Tilapia (GIFT) strain in India. The facility is developed over an area of 12.7 acres and comprises of 20 ponds (10 each of 300 sqm and 2600 sqm area respectively). The facility also has a breeding unit with incubation facilities for hatching of fertilized eggs and an All-male seed production unit with all ancillary infrastructure facilities that includes reservoirs, effluent treatment ponds and necessary bio-security measures.

The fully pedigreed selective breeding program with GIFT strain is being implemented in technical collaboration with M/s. World Fish Centre, Malaysia. The project imported fingerlings from 60 families of GIFT stocks during August 2011 and commenced selective breeding after growing them to broodstock sizes. The project has been successful in developing 46 families of G3 populations in India over the last three years. The project has also developed the capability for supply all male GIFT Tilapia fry/fingerlings for farming in India as well as to provide technology support for establishment of Satellite Breeding Centers for GIFT strain. Broodstock required for satellite breeding centers will also be

produced and supplied by RGCA. The project presently also holds stocks of Redline GMT (YY Technology) obtained from M/s. FishGen, UK.

## Activities and Achievements

### Selective Breeding Programme with GIFT

The selective breeding programme with GIFT (Genetically Improved Farmed Tilapia) strain continued at the project for the development of G2 stocks during the early part of 2013-14 and development of G3 stocks during the fag end of the financial year.

### Tagging of G2 generation stocks

Representative fish (around 70 nos) from each of the 50 families of G2 stocks obtained during the operations that concluded in June 2013 were tagged using PIT (Passive Integrated Transponder) tags. These tags were inserted into the abdominal cavity of each fish using an injector. The tagged animals were observed for a period of 24 hours for post tagging mortality/tag rejection. Subsequently, the animals were stocked uniformly in 3 different grow-out ponds (equal number of representatives from each family in each of the ponds of the same size) and reared to an average size of 250gms. These were subsequently harvested and the morphometric data of each fish were recorded again for the preparation of mating list for the production of the next generation.



### Mating Programme of G2 generation

A mating list was prepared after selecting the top performing, three male and female fish from each family in the communal rearing exercise. A total of 150 males and 150 females were identified and separated and the males subject to lip clipping to prevent them from injuring the females during mating. These stocks were conditioned by providing higher protein feed fortified with vitamin and mineral supplements. The mating



All-male seed production unit

programme commenced in the month of February by stocking selected males with selected 'Ready to spawn' females in respective 1 m x 1 m x 1 m sized mating hapas. Development of new families continued till the end of the year. By the end of March 2014, the selective breeding programme resulted in 91 spawnings resulting in 41 new G3 families.

### Genetic Gain Study

The project also simultaneously initiated a Genetic Gain experiment by simultaneous breeding of parent stocks from the G0 and G1 parent stocks which had been preserved, along with breeding of the G2 stocks. Growth gain among families of successive generations would be compared.

### All male GIFT seed Production

RGCA continued mass production trials for all male GIFT seed and supplied seeds to several Fisheries Departments and Universities in Tamil Nadu, Maharashtra and Kerala for their field grow-out farming trials and demonstrations. RGCA also provided seeds to

select farmers for RGCA Tilapia culture demonstrations in their ponds. The Tilapia project has fully standardized all-male seed production protocols and has been successful in the production of over 3 million all-male tilapia seeds during the year.

Around 1.74 million seeds were supplied by the project in 27 consignments to the above mentioned beneficiaries.

### Supply of broodstock to emerging Satellite Breeding Units

The project has developed selectively bred GIFT stocks that are ready to be supplied to emerging Satellite Breeding Centres across the country. These are supplied as Cohorts having representatives from different families that can be used for rotational mating for two to three years by breeding centres.

### New breeding unit for hatching eggs for selective breeding

Miniature jars with 2 litre capacity was designed for hatching of eggs collected from single female for the selective breeding programme. The existing breeding unit of Tilapia project is equipped with 28 jars each with 20 litre capacity and designed for hatching of eggs on a mass/commercial scale. The hatchery containers require only minimum volume of water and the system is operationally user friendly. All-male Tilapia seed production that is normally ceased during the period of mating in the selective breeding programme can now be continued uninterruptedly with the development of this unit.



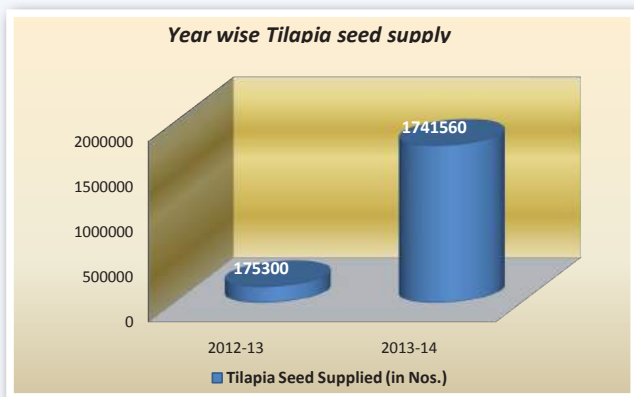
Breeding unit



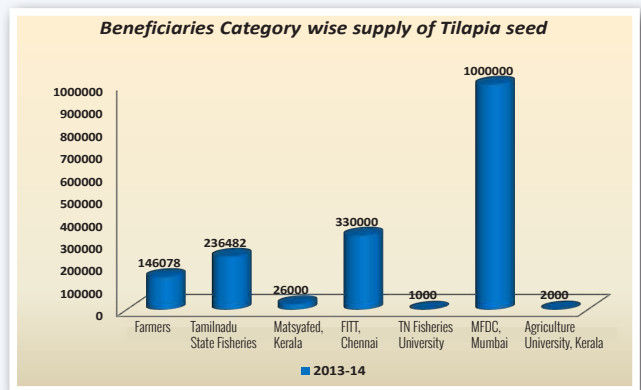
GIFT Tilapia



Hatching Jars designed for selective breeding operations



Year wise all male seed production



Category wise supply of All-Male Tilapia seed







Cobia brooders

# Pilot Scale Marine Finfish Hatchery Project

The Marine Finfish Hatchery Project of RGCA has been established at Pozhiyoor near Thiruvananthapuram to develop technologies for hatchery seed production of high valued export oriented species of marine finfish with cobia as the candidate species to begin with. The project also established a sea cage farm at Muttom, Kanyakumari District, Tamil Nadu for broodstock maintenance as well as to standardize and demonstrate



Marine finfish hatchery at Pozhiyoor

technologies for farming of cobia using hatchery produced seeds.

## Activities & Accomplishments

The project proved to the world that cobia can be bred throughout the year under captive conditions by achieving eight successful breeding cycles during the year 2013-14. Apart from mass production of cobia seed and grow-out farming demonstrations, the project also initiated sea cage culture of pompano *Trachinotus blochii*, snapper fish *Lutjanus* sp. and groupers *Epinephelus fuscogutatus* on trial basis.

The details of the activities at the project during the year are summarized below:

### Broodstock maintenance in recirculation systems

A total of 82 cobia broodstock were maintained at the project (75 in sea cage farm and 7 at the hatchery) out of which 11 were wild caught stocks and the remaining 71 were G1 progeny from the 2nd Grow-out trial.

### Induced Breeding of Cobia

The project achieved remarkable success in breeding cobia during the year 2013-14. It recorded eight successful spawning out of ten breeding attempts and achieved breeding all through the year. Break through was also achieved when cobia also spawned successfully in the RGCA sea cage farm at Muttom during March 2014 in the first attempt. A total of 27.12 Lakhs fertilized eggs were collected and transported to the hatchery after proper disinfection and stocked directly into the larval rearing tanks.

### Rearing of larvae and juveniles

Larval rearing protocols were further improved and standardized to achieve higher survival rates. Larvae were fed with enriched rotifers. Probiotics were used in larval rearing systems to maintain stable water quality parameters, enhanced nutrient utilization, waste removal and to eliminate pathogens from the system.

A total of over 32,000 cobia fingerlings (4-10 cm size) were produced during the year. While 50% of the quantity was supplied to farmers and Research



Larval rearing tanks



Cobia broodstock

Institutions, the remaining were stocked in the RGCA sea cage farm for grow-out farming demonstrations. During the year, around 8960 nos of cobia juveniles with an average length of 26 cm and body weight of 103 gm were shifted from the hatchery for grow out culture to Sea cage farm at Muttom.

### Sea cage farming

A total of 8960 nos of cobia juveniles were maintained in sea cage farm at Muttom for third, fourth and fifth grow out cage culture demonstration during the year. While the third batch had reached sizes of 4.2 to 4.7 Kgs, the 5<sup>th</sup> and 6<sup>th</sup> batches had attained sizes of 600 and 180 gms respectively.

### Sale and Export of sea farmed cobia

A total of 16,095 nos of fingerlings were supplied to the farmers and Research Institutes during the review period. About 36.3 metric tons of cobia produced at the RGCA sea cage farm at Muttom were harvested out of which 1542.4 kg of cobia in chilled form were exported to European Union, Canada and China.

### Marine Stock Enhancement Programme

A total of 8.94 Lakhs of 2 DPH hatchlings were ranced into the sea off Pozhiyoor coast in Arabian Sea during December 2013 as a part of RGCA's Marine Natural Stock Enhancement Programme of marine fishes.



Cobia Broodstock in cages in the Sea



RGCA Sea cage farm at Muttom in Tamil Nadu

### R & D trials with other Marine Finfish species.

Grow-out sea cage farming trials with Tiger Grouper were carried out at the RGCA sea cage farm, Muttom. Grouper fingerlings sourced from the RGCA hatchery at Andaman were reared at the hatchery in Pozhiyoor before transferred to the sea cage farm at Muttom. The stocks (around 175 Nos) were grown to an average size of 434gm, harvested and the produce was exported by a seafood exporter to the European union.

### Fabrication and mooring of off shore cages

The marine finfish hatchery commenced &

completed the fabrication of 3 (12.7m dia) HDPE cage system and mooring of offshore sea cage system during the financial year with technical assistance from Mr. HSIN CHUN. CHOU (ALIAS SIMON CHOU), the Engineer (Open Sea cage system) Consultant from Taiwan.

A 70 ft sea worthy vessel VAHAK fitted with a crane system was utilized for the operation of the offshore sea cage farm near Muttom coastal village, Kanyakumari District of Tamil Nadu.







Epinephelus fuscoguttatus (Tiger Grouper)

# Grouper Project

The Grouper Project of RGCA was initiated during the year 2006, with its hatchery facility located at Kodyaghat village in South Andamans and the sea cage farm of the project, located off Rutland Islands also in South Andamans. Technology development activities for breeding and seed production of tiger grouper *Epinephelus fuscoguttatus* as well as demonstration of grow out farming of hatchery produced fingerlings in open sea cages was carried out.

## Broodstock Maintenance

The project presently holds the broodstock of 4 species of groupers as detailed below. In addition to these broodstock caught from the wild, the project has also been able to develop F1 broodstock by rearing the hatchery produced seed of Tiger Grouper at the sea cage farm.

Species Name	Male	Female	Total nos
<i>Epinephelus fuscoguttatus</i> (Tiger grouper)	35	60	95
<i>Plectropomus areolatus</i> (Squaretail coral grouper)	03	12	15
<i>Cromileptis altivelis</i> (Mouse grouper)	01	02	03
<i>Epinephelus coioides</i> (Orange spotted grouper)	02	05	07

Present population of grouper broodstock in net cages

## Live Feed Culture

**Micro Algal culture:** Three species of micro algae are maintained viz. *Tetraselmis sp*, *Isochrysis sp*, and *Nannochloropsis sp*. All the species are maintained in proper condition without contamination.

**Rotifer culture:** *Brachionus plicatilis* and *Brachionus rotundiformis* are maintained in a temporary shed adjacent to M/s. Lakshadweep Shilpi hatchery.

**Copepod culture:** Copepod culture is continued in small scale in the temporary shed.

## Nursery section

About 35 nos of Orange Spotter Grouper fingerlings produced at the RGCA hatchery were maintained in the nursery section of the facility.

## Grow – out culture and production

Around 1338 Tiger Grouper fingerlings produced at the RGCA hatchery were stocked in sea cages at a density of 15-20 fish per m<sup>3</sup>.

The project presently maintains 1325 nos of Tiger Grouper ranging between 350 gms to 700 gms at a survival of 57%.

Sl.No	Date of stocking	Avg.Wt ( In gm)	Avg. Length (In cm)	Total Quantity stocked
01	02/08/2013	137	19.3	725
02	03/08/2013	126	17.8	375
03	23/09/2013	124	16.4	238
<b>Total fingerlings stocked</b>				<b>1338</b>

Morphometric details of Tiger Grouper juveniles stocked in sea cages

Sl.No	Av. Wt. (In gm)	Total Number	Total Biomass (in kg)
01	350	123	43
02	850	220	187
03	850	189	160.6
04	400	300	120
05	775	150	116.2
06	550	163	89.6
07	750	180	135
<b>Total</b>		<b>1325</b>	<b>851.4</b>

Growth details of hatchery produced Tiger Grouper juveniles stocked in sea cages



The Groupers reared in floating net cages were grown to marketable sizes and the R & D produce was supplied both as live fish as well as whole chill fish form. As on date 1060.5 kg of tiger grouper fish weighing above 500 gms was sold in chilled form for an amount of Rs.1,48,470/- and 287.8kg in live form @ Rs.200/- per kg for Rs.57,560/- to an export company.

### Land for Grouper Hatchery

The land allotted by the Andaman & Nicobar Administration in respect of survey no. 32/2 & 32/3 measuring an area of 0.4000 hect and 0.4125 hectare had been taken into possession by RGCA. The land area allotted has been fenced with barbed wire fencing. M/s. NIOT has been engaged to conduct Rapid Environment Impact Assessment for the allotted land in order to place it for CRZ clearance.

### Achievements

- ❖ Fingerlings of *Epinephelus coioides* (orange spotted grouper) was produced in the hatchery for the first time in India
- ❖ Sale of farmed tiger grouper in floating net cages from

hatchery produced fingerlings for the first time in India.

- ❖ Developed F1 generation Tiger grouper broodstock for the first time in India.



Orange spotted grouper (*Epinephelus coioides*) fingerlings

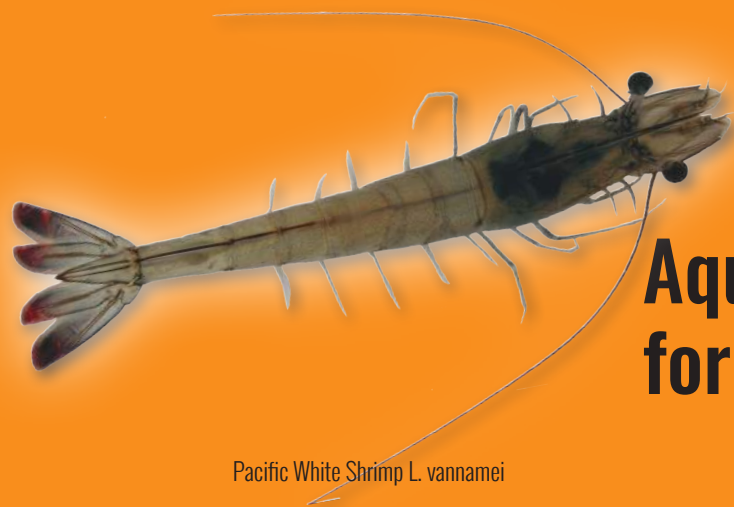


Harvested tiger grouper



Dr. Donald V. Lightner, Dr. Shaun Moss, Mr. Steve Arce, Dr.(Mrs.) B. Meenakumari, Ms. Leena Nair, IAS visiting the Quarantine Cubicles. Shri. Y.C. Thampi Sam Raj, Project Director explaining the activities of AQF at Chennai





# Aquatic Quarantine Facility for *L. vannamei* (AQF)

Pacific White Shrimp *L. vannamei*

The Aquatic Quarantine Facility for *L. vannamei* located at Neelankarai, Chennai, is a state of the art quarantine facility involved in quarantine of *vannamei* broodstock imported by the CAA approved stakeholders. The AQF facilitates quarantine services to the broodstock imported by *vannamei* hatchery operators under the Animal Quarantine & Certification Services (AQ & CS, Dept. of Animal Husbandry Dairying & Fisheries, Ministry of Agriculture). The facility ensures the specific pathogen free (SPF) status of the imported *vannamei* broodstock for the 6 OIE listed pathogens (WSSV, IHNV, NHPB, YHV/GAV, TSV & IMNV) and thus plays a pivotal role in restricting possible introduction of pathogens from other countries to India.

## Activities & Accomplishments

### Implementation of the Computerized Aquatic Quarantine Monitoring System (AQMS)

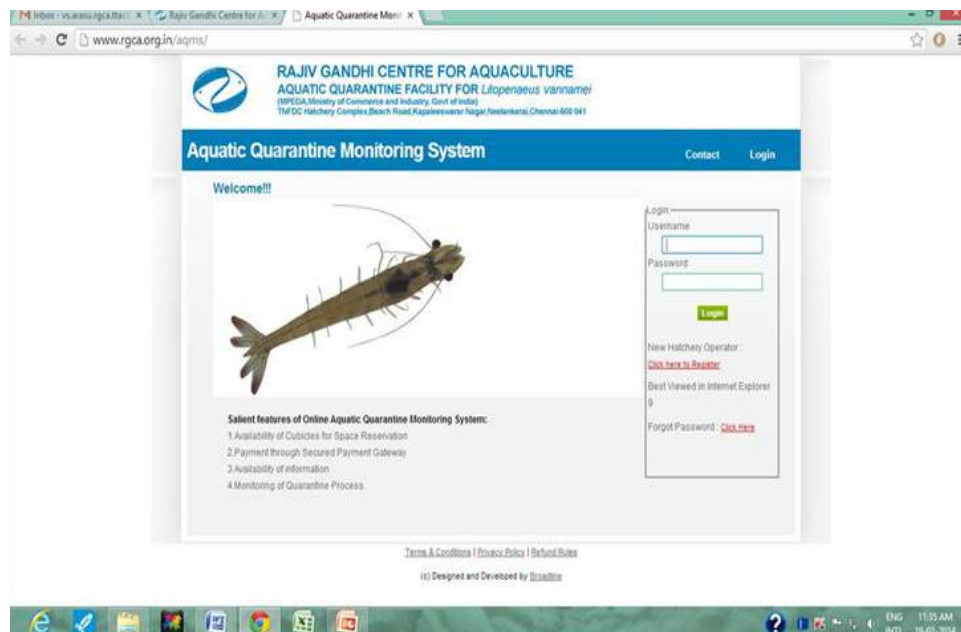
During the period under review, the AQF

successfully launched hassle free online quarantine space booking system, called the “Aquatic Quarantine Monitoring System” (AQMS) for the benefit of *vannamei* hatchery operators. The system enables the hatchery operators to book the space, online as per the requirement of their hatchery and also on their required day.

The AQMS also provides accessibility of the quarantine operation of the facility such as quarantine space booking, import and despatch of broodstock, quarantine survival of each imported consignments, condition of the broodstock at the time of its arrival, test report etc to the technical committee members involved in monitoring of AQF Operation. An arrival status report providing all the details of the consignment received at AQF, is also generated by the system and sent to the respective importers/hatchery operators via their registered mail ID. The AQMS commenced functioning from 16<sup>th</sup> May 2013 onwards and out of the 117 CAA approved hatcheries 115 had registered with AQMS, during the period under review.

### Quarantine of *vannamei* broodstock

The Coastal Aquaculture Authority (CAA) permitted 117 hatcheries to import 1,40,376 nos. of *vannamei* broodstock, from 9 approved *vannamei* broodstock suppliers, in 2013-14. A total of 211 lots were imported during the year out of which 209 batches were





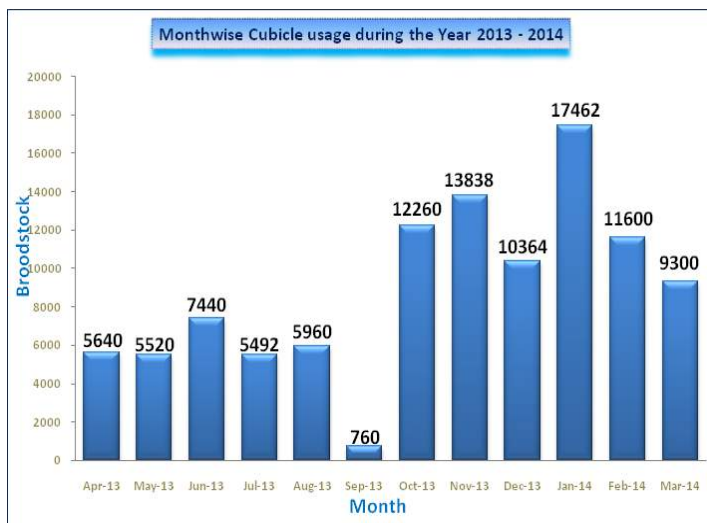
Inside view of second phase of AQF

from the supplier SIS, Florida, USA and 1 batch each from the suppliers SIS, Singapore and Kona Bay Marine Resources, Hawaii, USA.

A significant increase in the number of brood stock quarantined was also recorded by the facility, during the period under review. The total number of broodstock imported was 105636 (52818 males &

Among the 117 approved hatcheries, 105 had imported and quarantined the stock utilizing the services of AQF. Of this, three hatchery operators were recorded to import extra number of broodstock than the quarantine capacity of the reserved cubicles, i.e @ 16 kg biomass/cubicle. Therefore, the excess number of broodstock imported by these hatcheries were incinerated. The actual total number of broodstock quarantined excluding the transit mortality and the excess stock imported were 103614 nos. The number of broodstock despatched was 101854 nos. (51201 males and 50653 females) with mean quarantine survival of 98.31 % (n=211), calculated on the basis of live broodstock received by the facility.

A total of 2110 pleopod samples & 1055 faecal samples collected from the broodstock were extracted for the nucleic acids and subjected to nested PCR for the screening of OIE listed pathogens. All the broodstock samples tested for the 6 OIE listed pathogens, viz; WSSV, IHNV, NHPB, IMNV, TSV, YHV/GAV were examined to be free of the specific pathogens and hence were confirmed of their Specific Pathogen Free (SPF) status during this period.



52818 females) and that despatched were 101854 nos (51201 males & 50653 females). Similarly the number of broodstock consignments received for quarantine during 2013-14 was 211, in contrast to the number of consignments (135 nos) which were received in the previous year (2012-13).

### Quarantine Cycles

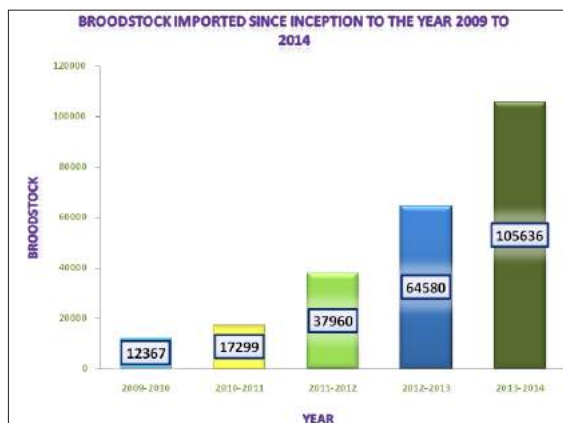
The total cubicle occupancy of the facility recorded during the current review period was 286. The number of quarantine cycles accomplished in each phase of the facility was 104 in phases I and III and 78 in phase II respectively.

### Quarantine of *vannamei* postlarvae

Five batches of *L. vannamei* postlarvae imported by M/S TASPARG, RGCA from Oceanic Institute, Hawaii were also quarantined by the facility and ensured of their SPF status. The quarantine details of the postlarvae consignments received and as tabulated below:

### Infrastructure Development

The facility expanded in tune with the expansion of the *vannamei* industry of the Country. To cater to the more number of hatcheries approved by CAA, an additional third and final phase was created. This phase



Broodstock imported since inception in 2009 to the year 2013-14

Sl.No	Imported (nos)	Date of arrival (nos)	Transit mortality (nos)	Despatched (nos)	Date of despatch	Quarantine survival (%) in terms of live larvae received at AQF
1	5000	08.04.13	105	4885	13.4.13	99.79
2	35000	23.08.13	6212	28788	27.8.13	100
3	5000	27.08.13	351	3784	31.8.13	97.80
4	24000	29.11.13	22000	1890	3.12.13	94.50
5	5000	17.01.14	639	3200	21.1.14	99.47

comprising of 13 quarantine cubicles was commissioned on 4<sup>th</sup> September 2013 by the world renowned shrimp pathologist, Dr. Donald V. Lightner, in presence of Ms. Leena Nair, IAS Chairman MPEDA & President RGCA and Dr. B. Meenakumari, Deputy Director General (Fy)

ICAR and was set into operation from 19<sup>th</sup> September 2013 onwards.

In concurrence to the expansion of the facility, amenities in the AQF-PCR lab was also strengthened so as to simultaneously screen more number of brood stock samples. A thermal-cycler of 96 well capacity, 2 Horizontal Laminar Airflow Chambers, a cooling microcentrifuge, Tissue Lyser, 5 submarine horizontal gel systems were also procured, during the review period 2013-14.



Inside view of a Quarantine Cubicle under operation



Ms. Leena Nair, IAS, President RGCA & Chairman MPEDA feeding Cobia brooders in the open Sea Cage farm at Muttom

The Technology Transfer Training and Administrative Complex (TTTAC), located at Karaimedu Village, Sirkali, Nagapattinam district functions as the nodal centre for the transfer of professionally, economically and environmentally viable and responsible aquaculture technologies developed by RGCA to the fisher folk, aquaculture farmers, aquaculturists, academicians, students, researchers and entrepreneurs from all over the country. The RGCA headquarters also functions from this complex.



## Technology Transfer Training & Administrative Complex



Fisher folk getting training on mud crab culture



Grading done by trainees

# Technology Transfer and Training Division

The Technology Transfer and Training Division is involved in transfer of technologies developed at various projects of RGCA to fishermen, aquaculture farmers, aquaculturists and entrepreneurs from all over the country through outreach programmes, seminars, workshops, awareness programmes and by actively participating in trade shows and fairs in aquaculture. These are organized based on the immediate as well as the long term needs of the industry. Details of extension programmes carried out during 2013-14 were:

## Training Programmes

### Best Husbandry practices on Asian Seabass culture

Two training programmes were conducted on best husbandry practices on Asian Seabass culture during the year. The main beneficiaries of the first programme conducted in the regional language (Tamil), were a group of 20 fisher folk from Pudukuppam and Poompuhar villages of Nagapattinam in the state of Tamil Nadu who intended to take up seabass culture in their villages with the financial support from M/s. M.S. Swaminathan Research Foundation. The training was organized in the regional language (Tamil). The MSSR Foundation proposed to provide seabass fingerlings for rearing in their community pond at Pudukuppam in order to take up seabass culture on a trial basis.

The second training programme was conducted for the benefit of a group of entrepreneurs & farmers from Uttar Pradesh, Madhya Pradesh, Andhra Pradesh and Tamil Nadu.

### Training programmes on Mangrove crab aquaculture

A total of nine training programmes were



Trainees fastening nets to Cage frames



A fully completed grow out cage ready for installation in ponds

organized on Mangrove Crab Aquaculture by RGCA during the year 2013-14.

Two programmes were organized for the benefit of a group of 20 fisher folk from Madavamedu village of Nagapattinam District and a seven members of Self Help Group from Pulicat lake of Thiruvallur District in Tamil Nadu. These groups intended to take up mud crab aquaculture in their respective villages.

Two programmes with a total of 16 participants were carried out for the benefit of farmers, entrepreneurs, technicians and consultants from different part of the Country.

Three training programmes were also organized for the benefit of the fisher folk from Sindhudurg district in Maharashtra who were involved in mangrove crab stock enhancement and eco-friendly aquaculture development in their area as a part of the UNDP project implemented by the Department of Environment and Forests, Maharashtra, NETFISH and MPEDA. 56 fisher folk and technical officers involved in the programme participated in the training.

Two more training programmes with a total of 32 participants were organized for the benefit of the fisher folk from Navi Mumbai district who were involved

in mud crab fattening activities and intended to take up mud crab aquaculture.

### Familiarization / Awareness Programmes

Fifteen Familiarization/Awareness programmes in new technology developments and aquaculture practices were conducted during the year 2013-14.

These one day / two days programmes that comprised of field visits to RGCA seabass hatchery, mangrove crab hatchery, Aquaculture Demonstration Farm and marine finfish hatchery project as well as the grouper hatchery and sea cage farm facilities. Presentations on technology developments were delivered at RGCA projects. Around 425 participants that included farmers, entrepreneurs, students of fisheries and aquaculture, govt. officials were benefitted through these programmes.



Grading of mangrove crablets by trainees



Group of International students visiting the RGCA Mangrove Crab Hatchery



Trainees feeding Crablets in Nursery Hapas



Trainees observing Seabass fingerlings in the hatchery

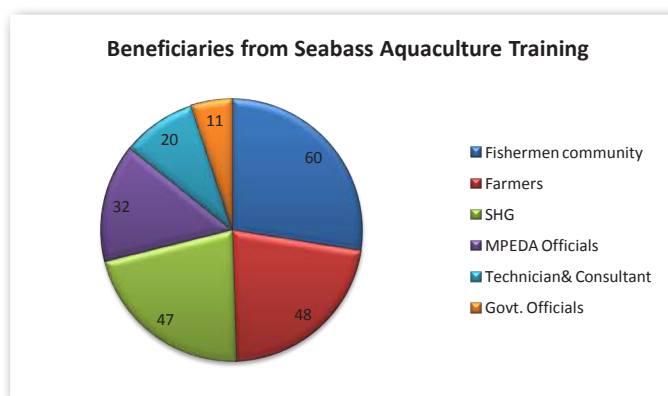


## Details of Technology Transfer Activities of RGCA

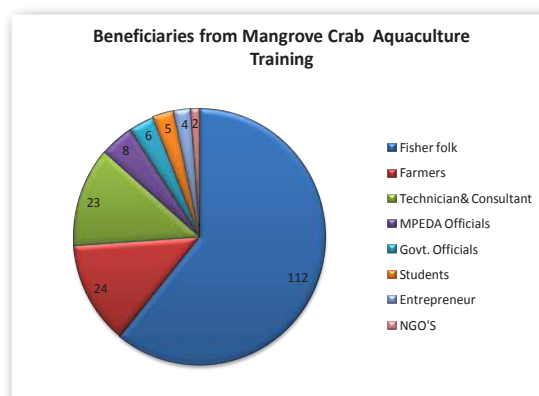
Details of Training programmes, Workshops/Seminars, Awareness programmes, categories of beneficiaries in each of them are presented in the following tables and figures:

S.No.	Training Programme	Number of Trainings conducted	Number of Beneficiaries
1	Cage culture of seabass	2	26
2	Mangrove crab aquaculture	9	131
<b>Total</b>		<b>11</b>	<b>157</b>

Training programmes conducted by RGCA during 2013-14



Beneficiaries from different categories of persons who underwent training in seabass aquaculture



Beneficiaries from different categories of persons who underwent training in mangrove crab aquaculture

S.No.	Seminar/Workshop	Targeted Group	Number of Beneficiaries
1	International Seminar on Mud crab Aquaculture and Fisheries management (ISMAF-2013)	28 International Delegates from 12 countries along with Indian Farmers, Technicians, Consultants, Govt. Officials, University faculties, NACSA & MPEDA Officials	150
2	Dr. E.G. Silas Endowment Lecture	Farmers, Technicians, Consultants, Govt. Officials, University faculties, NACSA & MPEDA Officials	139
3	Crisis management to contain spread of EMS in shrimp farms/hatcheries	Officials from MPEDA, NACSA & NETFISH	60
<b>Total</b>		<b>3</b>	<b>349</b>

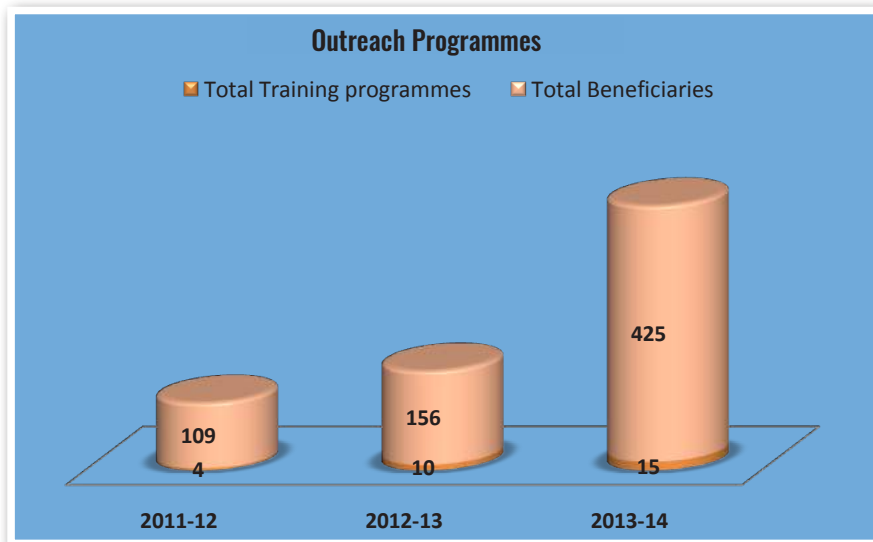
Seminars / Workshops conducted by RGCA during 2013-14



Hands on training on culture of GIFT Tilapia

S.No.	Familiarization/ awareness programmes	Programme conducted (Nos)	Beneficiaries (Nos)
I	Familiarization and awareness programme at RGCA TTTAC	15	425

Familiarization/Awareness Programmes conducted by RGCA during 2013-14



Outreach programmes organized during 2013-14



Hands on Training on Mangrove Mud Crab farming in progress



Transparency of water being checked with a Secchi Disc



Trainees washing the Crablets collected from the nursery Hapas



Soft Shell crab boxes being examined for presence of moulted crabs

# Central Aquaculture Genetics Laboratory

The various activities undertaken by the Central Aquaculture Genetics Lab of RGCA are detailed below:

Central Aquaculture Genetics Laboratory (CAGL) plays a pivotal role in on-going selective breeding programmes of various RGCA projects. The CAGL team is involved in formulating breeding programmes, constructing family pedigree and maintenance of breeding data required for selection of parents to produce next generation. Genetics lab is undertaking population genetic study for targeted species using advance molecular markers to determine founder population for selective breeding programme. The lab is involved in resolving taxonomic ambiguities of species with multiple molecular markers and pursuing sex-marker development.

A total of 699 tissue samples were collected during this period from commercially prioritized species comprising mangrove mud crabs, seabass and groupers from various locations of different coastal states of India including Andaman coastal waters for population genetic study. Samples were collected in duplicate whenever possible and tissue samples (muscle/fin/scales etc) were preserved in 95% ethanol. DNA was extracted from 437 different tissue samples mainly using phenol chloroform method. Quantity as well as quality of the DNA was checked and documented for each samples. A total of 1637 PCR reactions were performed for mitochondrial DNA and RAPD amplification. Sequencing reactions were performed for 472 samples during this period using the genetic analyzer at genetics lab. The region sequenced includes mtDNA 16S *rRNA*, *Cyt-b* and *mtDNA COI* mainly for Indian mangrove mud crab,

grouper and scampi. All the samples were sequenced in both forward and reverse directions and the sequenced regions were aligned and blasted for further studies.

## Achievements

❖ A paper entitled 'Molecular markers reveal only two mud crab species of Genus *Scylla* (Brachyura: Portunidae) in Indian coastal waters' authored by Anup Mandal, Mathews Varkey, Sobha P. Sobhanan, Anjali K. Mani, A. Gopalakrishnan, Ganesh Kumaran, Arulraj Sethuramalingam, Pandiarajan Srinivasan and Y. C. Thampi Samraj published in *Biochemical Genetics*, vol. 52 (3/4), April 2014. (Accepted: 16 December 2013; Springer, New York 2014). This is the first report from India resolving the taxonomic ambiguity of commonly available Indian mud crabs using a combination of several molecular markers along with traditional taxonomy. The importance of this study is immense because proper identification plays pivotal role in breeding and management of the particular species.

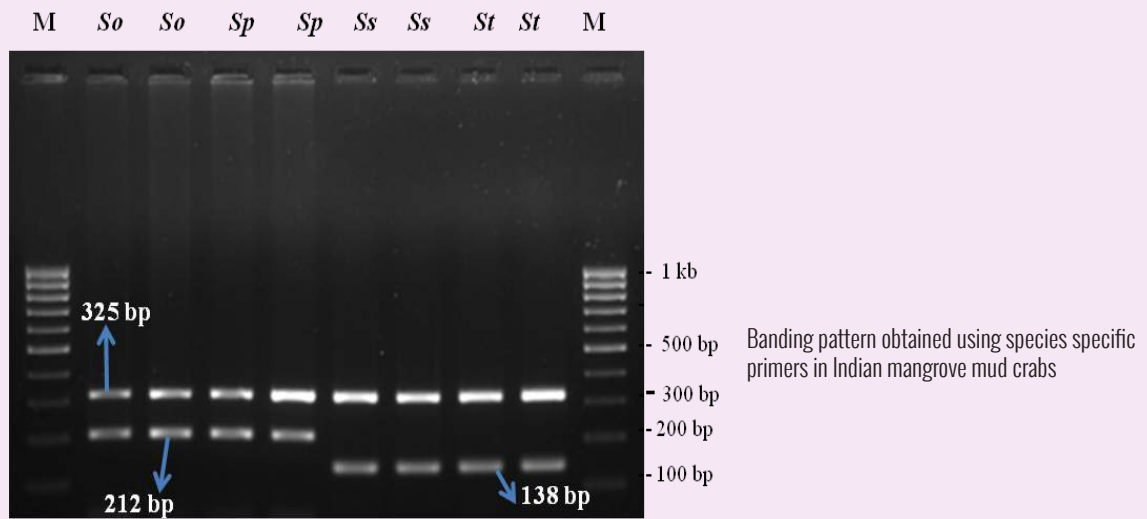
❖ CAGL has successfully submitted a research paper entitled 'Identification of Indian mangrove mud crab Genus *Scylla* spp (Brachyura: Portunidae) using RAPD and PCR-RFLP markers' by Mandal et al. in the *International Journal of Shellfish Research*.

❖ The CAGL published 37 unique sequences for mangrove mud crabs *Scylla serrata* and *Scylla olivacea* covering different regions of mitochondrial DNA include Cytochrome Oxidase-I (*COI*), Cytochrome b (*Cyt-b*) and 16S *rRNA* gene in *NCBI GenBank*. The sequences are available in the public domain with GenBank accession numbers (AB857337 to AB857359, AB861521 to AB861522, AB861881 to AB861887 and KC 200562 to

KC200565. This is the maximum contribution for mud crab sequences published in GenBank from India. The lab also submitted 13 Indian grouper unique sequences (GenBank accession nos.: KJ607962 to KJ607974) and 03 *Scylla serrata* sequences (GenBank accession nos : KJ607959 to KJ607961) for further studies.

was managed in collaboration with Oceanic Institute, Hawaii at Seven Seas farm situated at Srikakulam, Andhra Pradesh. Daily monitoring of feeding, water quality and health of the animals were done for nearly two months and very high percentage of survival and satisfactory growth of the animals were observed.

❖ Evaluation stream (ES-3) experiment of *L. vannamei*



Morphometric study of Indian mangrove mud crab at CAGL using digital callipers

# Central Aquaculture Pathology Laboratory

## Activities and Achievements

The Central Aquaculture Pathology Laboratory (CAPL) of RGCA has been providing diagnostic services to Aquaculture Industry & to all RGCA projects since its inception. During the year 2013-14, 1882 samples were processed and 11,566 PCR tests for various Shrimp/crab/fish pathogens were performed. 1901 samples were processed for disease diagnosis through histology. 851 samples were processed by the Microbiology Lab.

CAPL's targeted surveillance program detected AHPND in samples from Mahabalipuram & Nellore in October 2013. Continued targeted surveillance revealed 22 specimens with AHPND from Nagapattinam, Nellore, Prakasam, West Godavari Dt. CAPL has been successful in the two ring test / Proficiency test conducted by Aquaculture Pathology Laboratory (APL), University of Arizona, USA an OIE reference laboratory for crustacean diseases during August 2013 and Feb. 2014.

Details of samples processed at the CAPL for PCR and histology are listed in the undermentioned Tables

S. No	Sample Source	Total
1	DTSP, Andaman	826
2	Artemia project, Tuticorin	21
3	Local farmers	104
4	<i>L. vannamei</i> BMC, Visakhapatnam	81
5	Ring Test, University of Arizona	10
6	Mud crab hatchery, Thoduvai	97
7	Aquaculture demo farm, Karaikal	10
8	Cobia project, Pozhiyur	6
9	Seabass hatchery, Thoduvai	17
10	Scampi project, Vijayawada	296
11	OSSPARC	77
12	Surveillance by CAPL, RGCA	195
13	High health shrimp seed production unit (HHSSCP)	3
14	(IOAP) MPEDA	8
	<b>Total</b>	<b>1,751</b>

Details of samples processed at CAPL collected from farmers and RGCA projects

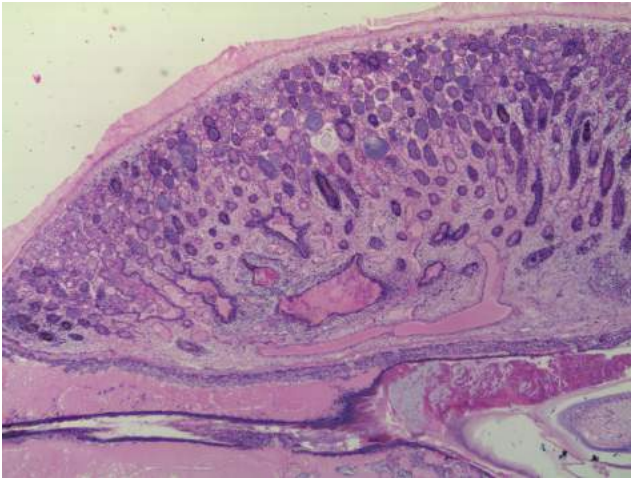
SAMPLE SOURCE	APR 2013	MAY 2013	JUN 2013	JUN 2013	AUG 2013	SEP 2013	OCT 2013	NOV 2013	DEC 2013	JAN 2014	FEB 2014	MAR 2014	TOTAL
DTSP,AN	35	-	-	4	40	30	54	-	-	103	12	125	403
SBNPC, OSSPARC	09	10	20	-	-	12	-	-	05	-	46	-	102
LvMC, VIZAG	-	2	2	4	12	-	-	-	17	-	3	-	40
MFFP POZHIIYOOR	2	4	-	-	-	-	-	-	-	-	-	-	6
TILAPIA, VIJAYAWADA	3	-	-	-	5	-	-	-	-	-	-	-	8
SCAMPI, VIJAYAWADA	-	6	-	-	-	-	-	-	-	2	-	-	8
SEABASS HATCHERY, THODUVAI	-	-	8	2	-	-	-	-	-	-	-	-	10
EMS SURVEILLANCE	-	-	-	-	-	-	-	478	406	2	-	62	948
RGCA SURVEILLANCE	3	21	2	27	-	27	13	-	-	22	60	146	324
CAPL R & D	-	-	-	-	5	-	-	16	11	20	-	-	52
<b>TOTAL SAMPLE</b>	<b>52</b>	<b>43</b>	<b>32</b>	<b>37</b>	<b>62</b>	<b>69</b>	<b>67</b>	<b>494</b>	<b>439</b>	<b>149</b>	<b>125</b>	<b>333</b>	<b>1902</b>

Details of samples processed by Histology at CAPL

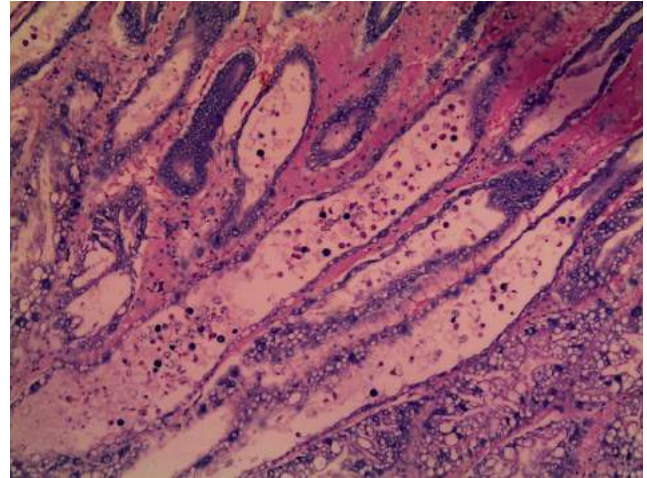


Sample collection and preservation during disease surveillance study programme





Septic Hepatopancreatic Necrosis (SHPN)



Early Mortality Syndrome (EMS)

### Study on Early Mortality Syndrome (EMS/AHPND) carried out by the Central Aquaculture Pathology Laboratory

#### RGCA/MPEDA initiatives on EMS/AHPND

- ❖ In view of the import of *L. vannamei* broodstock from EMS infected regions into the country, MPEDA-RGCA initiated targeted surveillance during 2012 in shrimp farms at AP & TN to keep a watch on the EMS/AHPND. Histological sections of affected tissue showing pathological features were thoroughly studied from published information worldwide.
- ❖ Established a disease surveillance programme during 2012 and commenced samples collection from Shrimp farms in Tamil Nadu and Andhra Pradesh to carry out histological studies.
- ❖ RGCA organised Shrimp Pathology workshop at RGCA, Sirkali during January 2013 by engaging senior faculty members from APL,UAZ,USA. The workshop focused on AHPND pathology.
- ❖ MPEDA-RGCA organized the first Dr. E. G. Silas Endowment Lecture programme on 5<sup>th</sup> September 2013 at RGCA, Sirkali dedicating the lecture on emerging shrimp diseases with special focus on EMS. Dr. Lightner the renowned shrimp pathologist delivered the lecture.

- ❖ Dr. Lightner explained the research carried out by APL, UAZ on AHPND & the approach adopted by the APL & eventual identification of the causative agent. Dr. Lightner had clarified that live broodstock as prime source of infection and cautioned India on the threat from shrimp broodstock from infected regions.
- ❖ RGCA disease surveillance studies intensified during 2013. Shrimp farms that reported any kind of disease/ mortalities within 10 – 70 days of stocking were targeted for sample collection
- ❖ During the course of the initial targeted surveillance, 200 samples were collected from shrimp farms in AP & TN.
- ❖ Samples collected between the end of September to beginning of October 2013 from the farms located at Mahabalipuram, Tamil Nadu & Nellore, Andhra Pradesh respectively showed AHPND pathology during histological examination at Central Aquaculture Pathology Lab, RGCA, Sirkazhi, TN
- ❖ These samples were referred to Dr. Lightner's Lab, APL, University of Arizona, USA for confirmation. APL confirmed AHPND in these samples by histology as well as by PCR test developed to detect the specific strain of *Vibrio parahaemolyticus*, the causative agent of AHPND (APL , UAZ Report Case -13-434/ 29-10-2013)



A shrimp with deformities observed during sampling

- ❖ Upon confirmation from the UAZ, Area of surveillance study increased to incorporate all the major shrimp farming areas in the East Coast by engaging field officers of MPEDA, NaCSA and NETFISH with support from RGCA-pathology lab.
- ❖ A one day training workshop was conducted on 11<sup>th</sup> November, 2013 for MPEDA, NaCSA, NETFISH and RGCA officials. The officials were provided with information on AHPND and methodology to be followed for the surveillance.
- ❖ Over 1000 samples from all across the East Coast of the country were collected and analysed at the RGCA CAPL
- ❖ Successfully participated in Ring Test (Proficiency Testing) from Aquaculture Pathology Laboratory, University of Arizona.

### Research and Development

Species level characterisation of bacterial pathogens in shrimp and fish cultured were

done using 16srDNA sequencing. The following pathogens, *Photobacterium damsela* subsp. *damsela*, *Vibrio parahaemolyticus* and *Vibrio brasiliensis* were identified from pure cultures and maintained in the culture repository.

Molecular identification of Infectious Hypodermal and Hematopoietic Necrosis Virus (IHHNV) in India was done by sequencing partial region of non-structural region 2 of the viral genome from infected samples. The sequences were analysed using BLASTn module in NCBI. The sequences showed high similarity 97-99% with previously submitted IHHNV sequences.

Viral Nervous Necrosis (VNN) was identified from infected wild Cobia (*Rachycentron canadum*) using RT- Nested PCR and histological analysis of the infected samples revealed lesions in the retina & brain. The betanodavirus disease were characterised by vacuolating encephalopathy and retinopathy.

PCR analysis for virulent bacterial isolates of *Vibrio* spp. was done using PCR primers targeting Tox-R and pathogenicity island genes. The presence of this highly pathogenic *Vibrio* spp. in SHPN (septic Hepatopancreatic Necrosis) was also revealed, histopathological studied with the infected samples revealed bacterial masses colonizing in the HP tubule lumens.

### Sample processed at CAPL Microbiology Laboratory during the report period

S.N	Sources of sample	No.of samples
1	RGCA & AHPND( EMS ) Surveillance	233
2	Sea bass& Mud Crab hatchery Project	211
3	Marine Finfish Project	12
4	Tilapia project	22
5	Giant Fresh water Prawn Project	12
6	Farmer sample	360
7	CAPL Infection Study and other R& D	121
	<b>Total</b>	<b>971</b>

# Aquaculture Library

A state-of-the-art library, solely devoted to Aquaculture and allied subjects is developed at RGCA. This aquaculture library, the first one of its kind in India, in addition to catering to the information needs of the scientists in Aquaculture R&D at the various centres of RGCA is also committed to serve the aquaculture information seekers within and outside India.

The aquaculture library has an impressive collection of both print and online resources including books, journals, technical reports and various publications with separate sections for farmed species across the world with special reference to species formed in Asia. In addition library provides information resources on different aquaculture systems across the world. This

aquaculture library has been further strengthened during this year with the additions of latest books in field of aquaculture and allied subjects. The library also subscribes reputed international journals and provides online access to all scientists and staff of RGCA.

The library maintains a separate section for “Dr. E. G. Silas Endowment Library”. The endowment library houses more than 6000 aquaculture and fisheries books, journals, rare publications etc.

Most of the operations in the library have been computerised. Online Public Access Catalogue (OPAC) is available in the INTERNET via Institute’s web site.



Journal display racks at Modern Aquaculture Library of RGCA



Ms. Leena Nair, IAS lighting the ceremonial lamp



Dr. Emilia T. Quintino, SEAFDEC addressing the participants of ISMAF



Dignitaries on the dais during the Inaugural session of the workshop ISMAF-13

# Seminars and Workshops

# International Seminar cum workshop on Mud crab Aquaculture and Fisheries management (ISMAF 2013)

A three day International Seminar cum Workshop on Mud crab Aquaculture and Fisheries Management (ISMAF 2013) was organized by RGCA in collaboration with the Aquaculture Department of Southeast Asian Fisheries Development Centre (SEAFDEC), Philippines from 10<sup>th</sup> to 12<sup>th</sup> April 2013 at the Technology Transfer Training and Administrative Complex (TTTAC), Karaimedu, Sirkazhi. The event was inaugurated by Dr.(Mrs.) B. Meenakumari, Deputy Director General (Fy) of Indian Council of Agricultural Research, New Delhi in the presence of Ms. Leena Nair, IAS., Chairman MPEDA & President RGCA, Dr.E. G. Silas, Former Director, Central Marine Fisheries Research Institute & Former Vice Chancellor, Kerala Agriculture University, Shri. T. Munuswamy, IAS, Dist. Collector of Nagapattinam, Dr. Emilia T. Quintio, SEAFDEC, Shri. Y. C. Thampi Sam Raj, Project Director, RGCA and a gathering of eminent scientists and mud crab technocrats

from across the globe. Dr. E.G. Silas, Chairman, SAC of RGCA delivered the Keynote address at the event.

This unique workshop was attended by about 150 participants represented from 11 foreign countries such as Philippines, Thailand, Bangladesh, Myanmar, China, Kenya, Malaysia, Indonesia, Bahrain, Palau Islands and France. The seminar was focused on the importance of mud crab culture in boosting a country's economy, through sustainable culture techniques and also to conserve the natural mud crab resources. This was the first and the unique mud crab seminar in India that had such a huge International participation.

The delegates placed their ideas in the form of 31 presentations and 10 posters. The seminar was followed by two very important workshops. The first workshop had two scientific themes, one on 'biology



Participants and Dignitaries of ISMAF 2013

and husbandry' and the other on 'genetics and ecology'. The second workshop was on mud crab 'fisheries management'. These workshops were interactive and delegates discussed several issues regarding various aspects of mud crab research. In an unanimous

resolution during the event, the delegates agreed to re-emphasize the name of mud crab as 'mangrove crab'. The programme concluded on the 12<sup>th</sup> April with field visits to RGCA mud crab hatchery and demonstration farm.

## Glimpses of ISMAF 2013



Dr. B. Meenakumari, DDG (Fy), ICAR, New Delhi honouring Dr. Emilia T. Quinitio, SEAFDEC,



Dr. Ganesh K and Dr. G.K Dinakaran of RGCA receiving the best paper presentation award from Dr. E.G Silas



Participants of ISMAF 2013



Participants of ISMAF 2013



Participants observing live feed culture in Mangrove crab hatchery



Entertainment programme by the participants



Dr. E.G. Silas addressing the gathering

## Inaugural edition of the Annual Dr. E.G. Silas Endowment Lecture

RGCA organized the first annual edition of "Dr. E.G. Silas Endowment Lecture", on 5<sup>th</sup> September 2013 at Technology Transfer Training & Administrative Complex of RGCA, Sirkali, as a part of its Technology Transfer mission. The event was organized as a tribute to the valuable contributions of Dr. E. G. Silas, one of the most revered personalities in the field of fisheries & aquaculture research sector in the country to RGCA as well as to the Aquaculture & Fisheries sector on the whole.

The programme was inaugurated by Hon'ble Justice Shri. K. Raviraja Pandian, Chairman CAA in the presence of Ms. Leena Nair IAS, President RGCA, Dr. E.G. Silas, Chairman, Scientific Advisory Committee of

RGCA, Dr. B. Meenakumari, Deputy Director General (Fy), ICAR and Dr. A.G. Ponniah, Director, CIBA. World renowned Shrimp Pathologist Dr. Donald V. Lightner, Professor & Director of OIE Reference lab for Crustacean Diseases, University of Arizona, Tucson, USA delivered the Dr. E.G. Silas Endowment Lecture while experts in Shrimp Domestication, Dr. Shaun Moss and Mr. Steve Arce from Oceanic Institute, USA gave presentations on the "Overview of Selective Breeding in the Pacific White Shrimp *L. vannamei*" and "Biosecurity requirements in *L. vannamei* aquaculture" respectively.

At a time when the Shrimp Industry of the country is at crossroads, trying to prevent the dreaded



Dr. Donald V. Lightner, University of Arizona, Tucson, USA lighting the ceremonial lamp





Dignitaries on the dais

Early Mortality Syndrome (EMS), (the disease which causes mass mortality/death of shrimps right from the time of stocking in farms) that devastated the shrimp culture industry in many of the Southeast Asian Countries, RGCA as a part of its mission mandate to transfer first hand and timely information on EMS to the Indian shrimp farmers, invited Dr. Donald. V. Lightner, the discoverer of the etiological agent of this dreaded disease to deliver an interactive lecture on the Emerging diseases in farmed shrimp with special focus on “Early Mortality Syndrome”. RGCA took initiative to organize this event so as to apprise the Indian shrimp farmers, hatchery operators, feed processors etc about this emerging disease of the shrimps, as “shrimps” form the major seafood export item that facilitates to earn 1.2 billion dollars to the country.

RGCA also identified the necessity of an awareness lecture on to improve the best management practices in shrimp aquaculture for the benefit of Indian farmers, required to sustain the Country’s shrimp industry in a responsible manner. Accordingly, Dr. Shaun Moss, Acting President, Research & Development at the Oceanic Institute, Hawaii the Pioneers in the



Dr. B. Meenakumari delivering the presidential address

development of Specific Pathogen Free stocks of *L. vannamei*, along with his team were invited to conduct a Workshop on “Biosecurity requirements in Shrimp Aquaculture” in the afternoon session during the event.

The event, organized by RGCA for a restricted audience turned out to be a highly successful one with an overwhelming response from the scientific fraternity



Participants and invitees

Participants for the workshop included aqua farmers, shrimp hatchery operators, feed producers, exporters, scientists and academe about the emerging diseases in shrimp industry and the need for maintaining bio security.

### Crisis Management Workshop to contain spread of EMS in shrimp farms/hatcheries

A one day workshop on “Crisis management to contain spread of EMS in shrimp farms/hatcheries” was organized by RGCA on the 11<sup>th</sup> November 2013 at Hotel Maathus, Chennai for the officials from MPEDA, NACSA & NETFISH. Around 60 officials of the MPEDA, NACSA & NETFISH from the states of Andhra Pradesh, West Bengal, Orissa, Tamil Nadu and Kerala participated. This training imparted shrimp sample collection and preservation techniques for histological and molecular (PCR) analysis of samples for disease surveillance programme. Officers who attended the programme have successfully carried out sample collection from the farms and hatcheries and over 1000 samples from across the east coast of India have been collected.

# Infrastructure Developments

RGCA continued to develop new infrastructure as well as to strengthen its already developed infrastructure to support and sustain the Aquaculture production base in the country. Unlike other sectors, Infrastructure Development for Aquaculture Technological Developmental Projects needs a holistic approach to provide healthy husbandry management in severe conditions of environmental exposure.

Several facilities with major roles to play in the future that support the ongoing Aquaculture systems in the country as well as promote the farming of new species of farmed finfish & shellfish are in different stages of development at various project locations. The details of infrastructure development activities at various projects of RGCA developed/commissioned during 2013 -14 across the country are briefed below:

## ❖ Domestication of Tiger Shrimp Project(DTSP)

With the completion of construction of the facilities & installation of the Recirculation Aquaculture Systems (RAS), the state-of-the-art biosecure facility was dedicated to the nation on 28<sup>th</sup> February 2014.

## The infrastructure created at Amkunj, Middle Andaman, A & N Islands

Pre-Primary Quarantine unit (250 m<sup>2</sup>), Primary Quarantine unit (360 m<sup>2</sup>), Disease Challenge Test unit (40 m<sup>2</sup>), Transit Quarantine Block & Breeder Holding section (260 m<sup>2</sup>), Spawning Room (150 m<sup>2</sup>), Workers Dormitory (36 m<sup>2</sup>), Store (54 m<sup>2</sup>), Reservoir (3 nos 5 MT each) etc

## Secondary Quarantine Unit (SQU), Kodiaghat, South Andaman, A & N Islands

The SQU built in a plinth area of 1680 m<sup>2</sup> comprises of 12 cubicles with 15 MT FRP tanks each connected to exclusive RAS, Indoor Algal Lab, Wet lab and Feed preparation unit, Shower Cubicles etc.

## Nucleus Breeding Centre, Kodiaghat, South Andaman, A & N Islands

The Maturation & Nursery Block (2030 m<sup>2</sup>) located at an elevated area comprises of Maturation & Nursery Units (2 Nos each). Each unit comprises of 6 nos of 15 MT FRP tanks with dedicated RAS. Entry point for these units is only through Shower cubicles.

Grow-out units A & B. (1220 m<sup>2</sup>each) contain raceways of 100 MT (4 nos in each unit) connected to



Arial view of the secondary quarantine unit



Inside view of a cubicle of the SQU



Aerial view of the Nucleus Breeding Centre at South Andaman

RAS (2 nos in each unit), entry for which is only through Shower cubicles other major infrastructure created at NBC includes 1200 MT reservoir connected to ozoniser & filtration units, ETP (665 WSA), Rain Water Harvesting, Blower Shed, Pump Room, Administration Block (675 m<sup>2</sup>), Electrical Service Block (210 m<sup>2</sup>), Store & Workshop (480 m<sup>2</sup>), Incineration unit, tyre bath etc.

#### **Aquatic Quarantine Facility for *L. vannamei*, Neelankarai, Chennai**

With the commissioning of the final phase AQF capacity of the facility has been increased to 20 quarantine cubicles connected to independent Recirculation

Aquaculture System (RAS). All these units are divided in 4 blocks, each of which contain its own receiving area, micro filtration room, blower room, packing room, sea water chiller units, etc.

#### **The facility encompasses the following**

The Four Cubicle block (840 m<sup>2</sup>), Three Cubicle block (1138 m<sup>2</sup>), Six Cubicle block (1396 m<sup>2</sup>), Seven Cubicle Block (1745 m<sup>2</sup>), Sea Water Reservoir (4200 MT), Filtration Room (296 m<sup>2</sup>), Fresh Water treatment block (116 m<sup>2</sup>), Electrical service block (105 m<sup>2</sup>), ETS (475 m<sup>2</sup>), Staff & Workers Dormitory (484m<sup>2</sup>)



Fresh Water Treatment Plant



Mangrove crab hatchery at Thoduvai, Sirkali

### Mangrove Crab Hatchery, Thoduvai, Sirkali, Nagapattinam, Tamil Nadu

The Mud Crab hatchery (1485 m<sup>2</sup>) was commissioned in April 2013. The facility consists of broodstock, Artemia Biomass, Larval rearing, Algal & Rotifer sections with FRP tanks of requisite capacities for rearing. The associated infrastructure includes Sea Water Reservoir (600 MT), Over Head Tank (150 T), Effluent Treatment System (300 MT), DG Room, Panel Board Room, Blower Room etc.

- ◆ Rotifer section - 197 m<sup>2</sup>.
- ◆ Algal section - 192 m<sup>2</sup>.
- ◆ Live feed section - 62 m<sup>2</sup>.
- ◆ Broodstock section - 100 m<sup>2</sup>.
- ◆ Artemia biomass section - 225 m<sup>2</sup>.

- ◆ Larval rearing section - 290 m<sup>2</sup>.
- ◆ Packing Area - 65 m<sup>2</sup>.
- ◆ Lab - 16 m<sup>2</sup>

### Broodstock Multiplication Centre, Rajakamangalam, Nagercoil

The works comprising of the land development, compound wall, security rooms, culvert etc quantified as under have been developed.

- ◆ Land developed (Plot A & B) - 94971 m<sup>2</sup>.
- ◆ Compound wall (Plot A & B) - 1722 m.
- ◆ Security room (2 Nos) - 14.6 m<sup>2</sup>. Each.
- ◆ Culvert (2 Nos) - each 20 m long.
- ◆ Access road (red earth) - 3097 m<sup>3</sup>
- ◆ Access road (red earth) - 3097 m<sup>3</sup>



Newly constructed security shed & compound wall of the BMC

# Major Events of the Year

## Inauguration of the Mangrove Mud Crab Hatchery

A state-of-the-art exclusive mud crab hatchery has been developed and commissioned by RGCA at its own premises at Thoduvai, Nagapattinam District, Tamil Nadu. The hatchery has a capacity for the production of one million crab instars per annum and has already produced over 0.5 million instars till date. The hatchery was inaugurated on 9<sup>th</sup> April 2013 by Dr. (Mrs.) B. Meenakumari, Deputy Director General (Fy) of Indian Council of Agricultural Research, New Delhi in presence of Ms. Leena Nair, IAS., Chairman MPEDA & President RGCA, Dr. E. G. Silas, Former Director, Central Marine Fisheries Research Institute & Former Vice Chancellor, Kerala Agriculture University and Shri. P. Mohanasundaram, Director MPEDA.



Dr. Meenakumari DDDG(Fy), ICAR inaugurating the Mud Crab Hatchery of RGCA in the presence of Ms. Leena Nair, IAS, Chairman MPEDA & President RGCA and Dr. E. G. Silas, Chairman SAC



Dr. (Mrs.) B. Meenakumari, Deputy Director General (Fy), ICAR, New Delhi, handing over the crablets to the farmers in the presence of Ms. Leena Nair, IAS.



Dr. (Mrs.) B. Meenakumari holding a mud crab at the hatchery

### Commencement of SPF *L. vannamei* broodstock supply from the RGCA broodstock multiplication centre for *L. vannamei* at TASPARC in Visakhapatnam

RGCA commenced the supply of High Quality SPF *L. vannamei* broodstock to approved *L. vannamei* hatchery operators from the Broodstock Multiplication Centre for *L. vannamei* at TASPARC in Andhra Pradesh during April 2013. This is supplied at a very affordable price unlike the broodstock imported from overseas suppliers. A total of around 30000 SPF broodstock has been supplied from the facility till date. The *L. vannamei* BMC of RGCA has been carrying out an extensive evaluation study on the field performance of SPF families from the OI in India. Valuable feedback is also being collected from most of the major stakeholders with regard to the performance of the stocks. These inputs are being analyzed for further improvement of stocks.



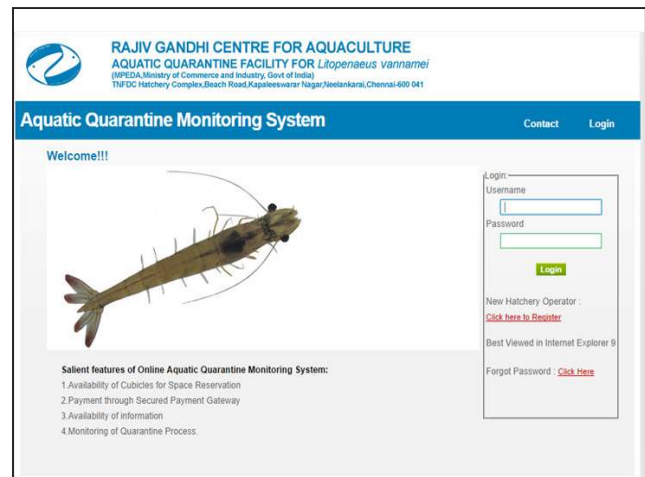
Healthy *L. vannamei* broodstock ready for supply



Visit of RGCA President to the facility

### Implementation of the Aquatic Quarantine Monitoring System

The development of the Online Quarantine Monitoring system with an online space reservation portal at the Aquatic Quarantine facility was completed and hosted at the website of RGCA at [www.rgca.org.in](http://www.rgca.org.in). The system was put into operation on 15<sup>th</sup> April 2013 and Online space reservation commenced with effect from 16<sup>th</sup> May 2013. Presently all space reservations at the facility is made by the stakeholders online and the system is functioning smoothly.



Snapshot of the AQMS home page

### Inauguration of the Final Phase of Aquatic Quarantine

The final phase of the Aquatic Quarantine Facility at Neelankarai, comprising of thirteen cubicles supported by eight receiving areas and other requisite ancillary structures and equipment was completed and inaugurated on 5<sup>th</sup> September 2013. This expansion was partly funded by MoC&I under the ASIDE scheme and partly by MoA through NFDB and built by RGCA as per RGCA norms. The quarantine cubicles and receiving area of the third and final phase was made operational within 6 months period as assured by RGCA to the MoA and Stakeholders.

World renowned shrimp pathologist, Dr. Donald V. Lightner, Professor and Director, OIE Reference Laboratory for Crustacean (Penaeid Shrimp) Diseases, School of Animal and Comparative Biomedical Science, University of Arizona inaugurated the facility in the presence of Ms. Leena Nair, Chairman, MPEDA and



Dr. Donald V. Lightner of the University of Arizona inaugurating the final phase of the AQF in the presence of Dr. B. Meenakumari, DDG (Fy), ICAR and Ms. Leena Nair IAS, President RGCA

President, RGCA, Shri. S. Vijayakumar, IAS, Secretary, DAHDF, Govt. of Tamil Nadu, Dr. E. G. Silas, Chairman, Scientific Advisory Committee of RGCA, Dr. B. Meenakumari, DDG (Fy), ICAR, and Dr. Shaun Moss, Acting President and CEO of the Research & Development wing of the Oceanic Institute, Hawaii and many other dignitaries.

The total strength of the Aquatic Quarantine Facility has now been boosted to 20 cubicles with a total quarantine capacity of approx. 2.37 lakh *L. vannamei* broodstock per annum.

The result of the strengthened quarantine infrastructure of AQF by RGCA is expected to cause further surge in the country's shrimp production and exports in the years to come. Through good management practice and highly professional and effective quarantine works, AQF serves as a cornerstone to prevent the possible negative impact resulting from the introduction and the spread of serious trans-boundary aquatic animal diseases.

### **Biosecurity Audit of the RGCA Shrimp Breeding Facilities**

A biosecurity Audit of the Domestication of Tiger Shrimp Project facilities at Andamans and *L.vannamei* BMC in Vizag was carried out during 14<sup>th</sup> to 19<sup>th</sup> April

2013 by the Aquaculture Pathology Laboratory of Dr. Lightner, which is an OIE referral Laboratory and an authorized international expert in conducting such Bio-security Audits. Dr. Carlos Pantoja, Associate Professor, Department of Veterinary Microbiology, University of Arizona carried out the Audit on behalf of APL. After the inspection of the facilities, an Audit report was submitted by APL, certifying the facilities of RGCA as Bio-secure facilities. These are the only facilities in the country certified as Biosecure Shrimp Breeding Facilities.

### **❖ Dedication of the Nucleus Breeding Centre of the Domestication of Tiger Shrimp Project at Andaman to the Nation**

#### **❖ Laying the foundation stone for the Multi-species Grouper Hatchery**

#### **❖ Laying the foundation stone for the Broodstock Multiplication Centre for Tiger Shrimp at Kanyakumari**

The Nucleus Breeding Centre of the Domestication of Tiger Shrimp Project (DTSP) of RGCA/MPEDA at Andaman was dedicated to the Nation on Friday, the 28<sup>th</sup> February 2014 by Shri. Anand Sharma, Hon'ble Union Minister of Commerce & Industry, Govt. of India. On the same day, the Hon'ble Union Minister also laid the foundation stone for the Multi-species Grouper Hatchery at Rangachang, Andaman and the Broodstock Multiplication Centre for Tiger Shrimp at Kanyakumari Dt., Tamil Nadu via satellite link.



Inauguration of BMC, Kanyakumari

Shri. T.K.A. Nair, IAS, Advisor to the Prime Minister of India and former Chairman MPEDA, Lt. Governor of Andaman & Nicobar Islands, Lt. General A.K. Singh, Shri. Bishnu Pada Ray, Hon'ble Member of Parliament, Andaman & Nicobar Islands, Shri. Rajeev Kher, Commerce Secretary, Govt. of India, Shri. Anand Prakash IAS, Chief Secretary, Andaman & Nicobar Islands were the other important dignitaries who graced the function. Dr. E. G.Silas, Chairman, Scientific Advisory Committee of RGCA, was present at the project site in Kanyakumari along with other dignitaries including the Shri. Shankar Lal Kumawat, IAS, Sub Collector of Kanyakumari District during the function.



Hon'ble Union Minister Shri. Anand Sharma releasing shrimp into the NBC tank



Chairman MPEDA showing the miniature model of NBC Facilities to the Hon'ble Minister



Participants & invitees during the programme



Hon'ble Union Minister of Commerce, Govt. of India, Shri. Anand Sharma (centre) along with Shri. Rajeev Kher IAS; Hon'ble MP of A & N Shri. Bishnu Pada Ray; Lt. Governor, A&N Lt. General A. K.Singh; Shri. T.K.A. Nair, IAS; Shri. Anand Prakash IAS; Ms. Leena Nair, IAS and Shri. Y. C. Thampi Sam Raj on the Dias during dedication of DTSP Project to the Nation.



# Publications from RGCA Team

- ❖ Anil Kumar P, Johnson D'Cruz, Dhandapani K, Aravind V S, Asokan K, Packiyaraj, Thinesh Santhar (2013) *Hatchery seed production and farming of Cobia*. Handbook on Aqua farming, MPEDA, Cochin. 52p.
- ❖ Anup Mandal, Divya Rao, Deepa Karuppaiah, Achamveetil Gopalakrishnan, Jayagopal Pozhoth, Thampi Sam Raj Y C , Roger W Doyle (2013) Population genetic structure of *Penaeus monodon*, in relation to monsoon current patterns in Southwest, East and Andaman coastal waters of India. *GENE*, 491: 149 – 157.
- ❖ Anup Mandal (2013) *Training report on Identification of specific molecular sex marker(s) for Indian strains of Macrobrachium rosenbergii* (Scampi). Department of Life science, National Institute of Biotechnology in the Negev Ben Gurion University Israel. Rajiv Gandhi Centre for Aquaculture, Sirkali. 32p.
- ❖ Anup Mandal (2013) *Training report on Tilapia genetics: workshop on Statistical methods and data analysis for selective breeding in Aquaculture: WFC Headquarters, Penang Malaysia, from 16th September 2013 to 21st September 2013* . Rajiv Gandhi Centre for Aquaculture, Sirkali. 19p.
- ❖ Biju V N, Jayagopal P, Dinesh Kumar H, Raju D V S N, Jaideep Kumar, Remany M C, Thampi Sam Raj Y C (2013) *Diseases of cultured shrimp and prawn in India*. Handbook on Aqua farming, MPEDA, Cochin. 104p.
- ❖ Gnanavel (2013) *Training report on Tilapia genetics: workshop on Statistical methods and data analysis for selective breeding in Aquaculture: WFC Headquarters, Penang Malaysia, from 16th September 2013 to 21st September 2013*. Rajiv Gandhi Centre for Aquaculture, Sirkali. 19p.
- ❖ Jaideep Kumar, Thampi Sam Raj Y C (2013) Update of the technology initiatives of Rajiv Gandhi centre for Aquaculture in providing diversification opportunities for export oriented Aquaculture in India. *Souvenir Aqua Aquaria India 2013: 08-10 February 2013, Andhra Loyola College campus, Vijayawada, Andhra Pradesh. MPEDA, Cochin*, pp. 121-147.
- ❖ Kadaimi Lakshmi Narayanan (2014) *Training report on Identification of specific molecular sex marker(s) for Indian strains of Macrobrachium rosenbergii* (Scampi). Department of Life science, National Institute of Biotechnology in the Negev Ben Gurion University Israel. Rajiv Gandhi Centre for Aquaculture, Sirkali. 32p.
- ❖ Mathews Varkey (2014) *Training report on Identification of specific molecular sex marker(s) for Indian strains of Macrobrachium rosenbergii* (Scampi). Department of Life science, National Institute of Biotechnology in the Negev Ben Gurion University Israel. Rajiv Gandhi Centre for Aquaculture, Sirkali. 32p.
- ❖ Pandiyarajan S, Anup Mandal, Ganesh K, Arulraj S, Thampi Sam Raj Y C (2013) *Breeding, seed production and farming of Mud Crab*. Handbook on Aqua farming, MPEDA, Cochin. 48p.
- ❖ Raju D V S N (2014) *Training report on Identification of specific molecular sex marker(s) for Indian strains of Macrobrachium rosenbergii* (Scampi). Department of Life science, National Institute of Biotechnology in the Negev Ben Gurion University Israel. Rajiv Gandhi Centre for Aquaculture, Sirkali. 32p.
- ❖ Remany M C, Daly Cyriac, Nagaraj S, Panda A K, Jaideep Kumar, Thampi Sam Raj Y C (2013) Evidence for the presence of WSSV and MBV in wild *Penaeus monodon* (Fabricius, 1798) broodstock in Southeast Coast of India. *Journal of Fish Diseases*, 35(11): 793 - 798.
- ❖ Remany M C, Panda A K, Jayagopal P, Jaideep Kumar, Thampi Sam Raj Y C (2013) Quarantine process of the exotic shrimp species, pacific white shrimp *penaeus vannamei* (Boone, 1931) broodstock in India. *Souvenir Aqua Aquaria India 2013: 08-10 February 2013, Andhra Loyola College campus, Vijayawada, Andhra Pradesh. MPEDA, Cochin*, pp. 111-119.
- ❖ Remany M C (2013) *Report on the International training course: Biology and Pathology of shrimp, Centex shrimp, Faculty*

of Science Mahidol University Bangkok Thailand. Rajiv Gandhi Centre for Aquaculture, Sirkali. 97p.

- ❖ RGCA (2013) Achievement of RGCA of MPEDA setting up: An unique shrimp quarantine facility of Chennai. *Fishing Chimes*, 33(6): 10-11.
- ❖ RGCA (2013) Best Husbandry practices for Asian seabass culture: the fisherman training programme conducted by Rajiv Gandhi centre for Aquaculture between 21-25 January 2013, in Thanjavur. *Fishing Chimes*, 33(1&2): 16.
- ❖ RGCA (2013) Dr.Lightner delivers the first Dr.E.G. Silas Endowment Lecture: Technology Transfer Administrative complex, Sirkali. *Fishing Chimes*, 33(8): 10-11.
- ❖ RGCA (2013) Dr.Lightner rates the RGCA Aquatic Quarantine facility as World class. *MPEDA Newsletter*, 1(6): 12-13.
- ❖ RGCA (2013) International seminar-workshop on Mud Crab Aquaculture and fisheries management. *MPEDA Newsletter*, 1(1): 10-11.
- ❖ RGCA (2013) MPEDA-RGCA opens the first and exclusive Mud Crab hatchery in India. *MPEDA Newsletter*, 1(1): 11.
- ❖ RGCA (2013) Precious moments for RGCA fraternity. *MPEDA Newsletter*, 1(7): 18-20.
- ❖ RGCA (2013) RGCA produces SPF L. Vannamei broodstock for the first time. *MPEDA Newsletter*, 1(1): 8-9.
- ❖ RGCA (2013) RGCA holds the first Dr.E.G. Silas Endowment Lecture *MPEDA Newsletter*, 1(6): 14-15.

- ❖ RGCA (2014) A Letter Day for Indian Aquaculture sea cage farming of cobia. *MPEDA Newsletter*, 2 (2):14-17.
- ❖ RGCA (2014) Nucleus breeding centre of the domestication of black tiger shrimp project dedicated to the nation. *MPEDA Newsletter*, 1 (12):5-9.
- ❖ RGCA (2014) RGCA Aquaculture Pathology Lab is India's first NABL accredited lab. *MPEDA Newsletter*, 2 (3):19.
- ❖ Rimmer M A, Thampi Sam Raj Y C, Jayagopal P, Thineshsanthar D, Damodar P N , Toledo J D (2013) Spawning of tiger grouper *Epinephelus fuscoguttatus* and squaretail coral grouper *Plectropomus areolatus* in sea cages and onshore tanks in Andaman and Nicobar Islands, India. *Aquaculture*, 410 – 411:197 – 202.
- ❖ Ruban L (2013) *Training report on Identification of specific molecular sex marker(s) for Indian strains of Macrobrachium rosenbergii (Scampi)*. Rajiv Gandhi Centre for Aquaculture, Sirkali. 32p.
- ❖ Sivakumar P (2013) *Training report on Tilapia genetics: workshop on statistical methods and data analysis for selective breeding in Aquaculture: WFC Headquarters, Penang Malaysia, from 16th September 2013 to 21st September 2013*. Rajiv Gandhi Centre for Aquaculture, Sirkali. 19p.
- ❖ Srinivasa Rao P (2013) *Training report on Tilapia genetics: workshop on Statistical methods and data analysis for selective breeding in Aquaculture: WFC Headquarters, Penang Malaysia, from 16th September 2013 to 21st September 2013*. Rajiv Gandhi Centre for Aquaculture, Sirkali. 19p.

## Patents during the year 2013-14

No new patents filed during the year.

### All Patents

RGCA had filed complete specifications at the Patent Office, Chennai for the following during the year 2012-13.

Sl.No	Patent File No	Title	Status
1	3641/CHE/2011 dated 24.10.2011	"MANGROVECRAB HATCHERY TECHNOLOGY"	Complete Specifications filed
2.	3077/CHE/2011 dated 7.9.2011	"TECHNOLOGY FOR CULTURE OF ASIAN SEABASS IN AQUACULTURE PONDS"	Complete Specifications filed

# Patents

# RGCA Submission to NCBI GenBank

The Central Genetics Laboratory of RGCA published 37 unique sequences for mangrove mud crabs *Scylla serrata* and *Scylla olivacea* covering different regions of mitochondrial DNA include Cytochrome Oxidase-I (COI), Cytochrome b (Cyt-b) and 16S rRNA gene in NCBI GenBank. The sequences are available in the public domain with GenBank accession numbers (AB857337 to AB857359, AB861521 to AB861522, AB861881 to AB861887 and KC 200562 to KC200565). This is the maximum contribution for mud crab sequences published in GenBank from India. The lab also submitted 13 Indian grouper unique sequences (GenBank accession nos.: KJ607962 to KJ607974) and 03 *Scylla serrata* sequences (GenBank accession nos.: KJ607959 to KJ607961) for further studies.

1. *Plectropomus areolatus* COI.sqn *Plectropomus areolatus* | KJ607966
2. *Epinephelus malabaricus* 16S.sqn *Epinephelus malabaricus* | KJ607974
3. *Epinephelus malabaricus* COI.sqn *Epinephelus malabaricus* | KJ607967
4. *Epinephelus longispinis* COI.sqn *Epinephelus longispinis* | KJ607970
5. *Epinephelus diacanthus* COI.sqn *Epinephelus diacanthus* | KJ607971
6. *Epinephelus areolatus* COI.sqn *Epinephelus areolatus* | KJ607969
7. *Epinephelus Formosa* COI.sqn *Epinephelus formosa* | KJ607968
8. *Epinephelus coioides* 16S.sqn *Epinephelus coioides* | KJ607973
9. *Epinephelus coioides* COI.sqn *Epinephelus coioides* | KJ607965
10. *Epinephelus fuscoguttatus* 16S.sqn *Epinephelus fuscoguttatus* | KJ607972
11. *Epinephelus fuscoguttatus* COI.sqn *Epinephelus fuscoguttatus* 3 | KJ607964
12. *Epinephelus fuscoguttatus* COI.sqn *Epinephelus fuscoguttatus* 2 | KJ607963
13. *Epinephelus fuscoguttatus* COI.sqn *Epinephelus fuscoguttatus* | KJ607962
14. *Temnopleurus toreumaticus* 16S.sqn *Temnopleurus toreumaticus* | KC262643
15. *Scylla serrata* 16S.sqn *Scylla serrata* 3 | AB857345
16. *Scylla serrata* 16S.sqn *Scylla serrata* 2 | AB857344
17. *Scylla serrata* 16S.sqn *Scylla serrata* 1 | AB857343
18. *Scylla serrata* Cytb.sqn *Scylla serrata* 9 | KJ607961
19. *Scylla serrata* Cytb.sqn *Scylla serrata* 8 | KJ607960
20. *Scylla serrata* Cytb.sqn *Scylla serrata* 7 | KJ607959
21. *Scylla serrata* Cytb.sqn *Scylla serrata* 6 | AB857353
22. *Scylla serrata* Cytb.sqn *Scylla serrata* 5 | AB857352
23. *Scylla serrata* Cytb.sqn *Scylla serrata* 4 | AB857351
24. *Scylla serrata* Cytb.sqn *Scylla serrata* 3 | AB857350
25. *Scylla serrata* Cytb.sqn *Scylla serrata* 2 | AB857349
26. *Scylla serrata* Cytb.sqn *Scylla serrata* 1 | AB857348
27. *Scylla serrata* COI.sqn *Scylla serrata* 4 | AB857346
28. *Scylla serrata* COI.sqn *Scylla serrata* 3 | AB861521
29. *Scylla serrata* COI.sqn *Scylla serrata* 2 | KC200564
30. *Scylla serrata* COI.sqn *Scylla serrata* 1 | KC200562
31. *Scylla serrata* 16S.sqn *Scylla serrata* 6 | AB857342
32. *Scylla serrata* 16S.sqn *Scylla serrata* 5 | AB857341
33. *Scylla serrata* 16S.sqn *Scylla serrata* 4 | AB857340
34. *Scylla serrata* 16S.sqn *Scylla serrata* 3 | AB857339
35. *Scylla serrata* 16S.sqn *Scylla serrata* 2 | AB857338
36. *Scylla serrata* 16S.sqn *Scylla serrata* 1 | AB857337
37. *Scylla serrata* Cytb.sqn *Scylla serrata* 13 | AB861887
38. *Scylla serrata* Cytb.sqn *Scylla serrata* 12 | AB861886
39. *Scylla serrata* Cytb.sqn *Scylla serrata* 11 | AB861885
40. *Scylla serrata* Cytb.sqn *Scylla serrata* 10 | AB861884
41. *Scylla serrata* Cytb.sqn *Scylla serrata* 9 | AB861883
42. *Scylla serrata* Cytb.sqn *Scylla serrata* 8 | AB861882
43. *Scylla serrata* Cytb.sqn *Scylla serrata* 7 | AB861881
44. *Scylla serrata* Cytb.sqn *Scylla serrata* 6 | AB857359
45. *Scylla serrata* Cytb.sqn *Scylla serrata* 5 | AB857358
46. *Scylla serrata* Cytb.sqn *Scylla serrata* 4 | AB857357
47. *Scylla serrata* Cytb.sqn *Scylla serrata* 3 | AB857356
48. *Scylla serrata* Cytb.sqn *Scylla serrata* 2 | AB857355
49. *Scylla serrata* Cytb.sqn *Scylla serrata* 1 | AB857354
50. *Scylla serrata* COI.sqn *Scylla serrata* 4 | AB857347
51. *Scylla serrata* COI.sqn *Scylla serrata* 3 | AB861522
52. *Scylla serrata* COI.sqn *Scylla serrata* 2 | KC200565
53. *Scylla serrata* COI.sqn *Scylla serrata* 1 | KC200563

# Participation in Fairs and Expositions

## 19<sup>th</sup> India International Seafood Show 2014:

Rajiv Gandhi Centre for Aquaculture actively participated in the 19<sup>th</sup> India International Seafood Show - IISS 2014 organized by MPEDA with SEAI from 10<sup>th</sup> to 12<sup>th</sup> January 2014 at the Chennai Trade Centre, Chennai. RGCA put up a large stall (85 sqm area) to showcase the various aquaculture technologies in several species developed at its centers. Live animals from different projects of RGCA were exhibited in



View of RGCA Stall



Shri. Anand Sharma, Hon'ble Minister of Commerce & Industry during the visit to the stall



Shri. N. Ramesh, Director(Mktg), MPEDA talking to the press at the RGCA stall.



Visitors observing the model net cages in the stall

Aquarium tanks and large FRP tanks. Miniature live models of cage farming of marine and freshwater fish were also displayed for the benefit of the entrepreneurs visiting the Expo.

# RGCA Meetings

## Executive Committee Meetings

Two Executive Committee Meetings were conducted during the year 2013-2014.

### 46<sup>th</sup> EC of RGCA

The 46<sup>th</sup> Executive Committee Meeting of RGCA was held on 23<sup>rd</sup> September, 2013 at MPEDA, HO, Kochi.

The members of EC of RGCA attended were as below:

1. Ms. Leena Nair, IAS, Chairman, MPEDA; President, RGCA.
2. Dr. (Mrs) B. Meena Kumari, DDG (Fy), ICAR, New Delhi
3. Shri. N. Ramesh, ITS, Director (Mktg), MPEDA
4. Shri. P. Mohanasundaram, Director, MPEDA
5. Shri. B. Sreekumar, Secretary, MPEDA
6. Smt. Noorjahan Beevi, JD (Inland Fisheries), Department of Fisheries, Govt. of Tamil Nadu, Chennai
7. Smt. E.V. Deepa, Chief Accounts Officer, MPEDA
8. Shri. Y.C. Thampi Sam Raj, Project Director I/C, RGCA.

### 47<sup>th</sup> EC Meeting of RGCA

The 47<sup>th</sup> Executive Committee Meeting of RGCA held on 28<sup>th</sup> March 2014 at MPEDA, HO, Kochi. The members of EC of RGCA attended were as below :

1. Ms. Leena Nair, IAS, Chairman, MPEDA/  
President, RGCA.
2. Shri. N. Ramesh, ITS, Director (Mktg), MPEDA
3. Shri. C.Munianathan, IAS, Director/  
Commissioner of Fisheries, Chennai
4. Dr. A.S. Ninawe, Sr.Advisor, DBT, New Delhi
5. Shri. B. Sreekumar, Secretary, MPEDA
6. Smt. Saira Banu K.A, Executive Director, ADAK,  
Trivandrum
7. Smt. E.V. Deepa, Chief Accounts Officer, MPEDA
8. Shri. Y.C. Thampi Sam Raj, Project Director I/C, RGCA.

## General Body Meeting

One Annual General Body Meeting was conducted during the FY 2013-2014

## 20<sup>th</sup> AGM of RGCA

The 20<sup>th</sup> Annual General Body Meeting of RGCA was held on 28<sup>th</sup> September, 2012 at MPEDA, HO,Kochi. The members of AGM of RGCA attended were as below:

1. Ms. Leena Nair, IAS, Chairman, MPEDA / President, RGCA.
2. Dr. George John, Sr. Advisor, DBT, New Delhi.
3. Dr. (Mrs) B. Meena Kumari, DDG (Fy), ICAR,New Delhi
4. Shri. N. Ramesh, ITS, Director (Mktg), MPEDA
5. Shri. P. Mohanasundaram, Director, MPEDA
6. Shri. B. Sreekumar, Secretary, MPEDA
7. Smt. G. Ramalakshmi, Director, Dept. of Fisheries, U. T of Pondicherry
8. Smt. Noorjahan Beevi, Joint Director (Inland Fisheries),  
Director of Fisheries, Chennai
9. Shri. Rema Devi, Regional Executive, ADAK, Trivandrum, Kerala
10. Shri. G. Rajendran, Chief Accounts Officer I/C
11. Shri. Y.C. Thampi Samraj, Project Director, RGCA.
12. Shri. C. Wilson, Deputy Director, MPEDA, RC, Thanjavur

## Scientific Advisory Committee Meeting

One Scientific Advisory Committee Meeting was held during the period 2013-2014.

25<sup>th</sup> Meeting of the Scientific Advisory committee of RGCA was held on 28<sup>th</sup> March'2014 at MPEDA, HO, Kochi. The under mentioned members attended the meeting :

1. Dr. E.G. Silas, Chairman SAC
2. Dr. George John Sr. Advisor, DBT, New Delhi
3. Dr. T. Santiago, Retd. Principal Scientist, CIBA
4. Dr. R.S. Biradar, Retd. Joint Director, CIFE, Mumbai
5. Prof. Dr. T. Balasubramanian, former Dean,  
CAS, Marine Biology, AU, Parangipettai
6. Dr. A. Gopalakrishnan, Principal Scientist & OIC, NBFGR,  
Kochi unit
7. Ms. Leena Nair, President RGCA – Ex-Officio Member
8. Shri. P. Mohanasundaram, Director MPEDA – Ex- Officio  
Member
9. Shri. Y.C. Thampi Sam Raj, Project Director, RGCA–  
Ex-Officio Member Secretary

# Participation in Training Programmes, Seminars and Workshops

## Abroad

S. No.	Name of the Staff	Training/Seminar	Organized by	Duration
1	1. Dr. Anup Mandal 2. Mr. P. Srinivasa Rao 3. Mr. M. Gnanavel 4. Mr. P. Siva Kumar	Data Analysis and Statistical Method involved in Selective Breeding of Tilapia	World Fish Centre, Penang, Malaysia	16 <sup>th</sup> – 20 <sup>th</sup> September 2013
2	1. Dr. Anup Mandal 2. Dr. D V S N. Raju 3. Mr. Mathew Varkey 4. Mr. K. LaxmiNarayana 5. Mr. L. Ruban	Identification of specific molecular sex marker (s) for Indian strain of <i>Macrobrachium rosenbergii</i> (Scampi)	Department of Life Sciences, The National Institute of Biotechnology in the Negev, Ben Gurion University, Israel	28 <sup>th</sup> December 2013 to 08 <sup>th</sup> January 2014
3	1. Mr. Ranjan Kumar Patra	'Biology and Pathology of Penaeid Shrimp 2013'	Shrimp Biotechnology Business Unit (SBBU), Bangkok, Thailand	30 <sup>th</sup> September to 11 <sup>th</sup> October 2013

## India

1	1. E. Ananda Jothi 2. P. S. Sobha	Training Programme on DNA Barcoding and Molecular Taxonomy of Fishes	National Bureau of Fish Genetic Resources (Cochin Unit) at CMFRI, Cochin	16 <sup>th</sup> September to 21 <sup>st</sup> December 2013
2	1. Shri Jaideep Kumar 2. H Dinesh Kumar 3. K Ganesh 4. B. Narasimha Rao 5. B. Appala Naidu 6. S. Moovendhan 7. K. Kanaka Chinthaiah	AquaIndia 2014. Sustaining momentum & spreading success	Society of Aquaculture Professionals (SAP) at Vijayawada, Andhra Pradesh	24 & 25 <sup>th</sup> January 2014
3	1. K.Ganesh 2. S. Arul Raj 3. Velumurugan 4. P U Sujith 5. S. Viswanathan	Training Programme on 'Fire Safety'	M/s Usha Fire Safety, Chennai	13 <sup>th</sup> September 2013

# Presentations/Lectures made by RGCA team at various forums

❖ **Ganesh K**, Project Manager, Seabass hatchery made a presentation on Prospects of Cage farming for the benefit of fishermen community at RDO office, Muttom on 14<sup>th</sup> February 2014.

❖ **Ganesh K**, Project Manager, Seabass hatchery participated in a Seabass farm harvest function organized by MPEDA at Orathanadu and delivered a lecture on prospects of Seabass farming to the gathering on 6<sup>th</sup> February, 2014

❖ **Ganesh K**, Project Manager, Seabass hatchery Project presented a paper on 'High density rotifer production for Mud Crab hatchery operations' during the "International Seminar – Workshop on Mud Crab Aquaculture and Fisheries Management" conducted by RGCA on 10<sup>th</sup> to 12<sup>th</sup> April` 13 at TTTAC, Karaimeedu, Sirkali

❖ **Shri. H. Dinesh Kumar**, Manager, *L. vannamei* BMC gave a lecture on *L. vannamei* Broodstock Management at a One day Seminar on "Current Trends In Culturable *Penaeid* Species In Indian Aquaculture Systems" organised by the Department of Marine Living Resources of Andhra University on 03.02.2014.

❖ **Shri. M. Saravanan**, Assistant Technical Manager, Mangrove Crab Project presented a paper on mud crab hatchery management for large scale production of crab

instar" during the International Seminar-Work shop on "Mud Crab Aquaculture and Fisheries Management" Conducted by RGCA on 10<sup>th</sup> to 12<sup>th</sup> April` 13 at TTTAC, Karaimeedu, Sirkali.

❖ **Dr. Anup Mandal**, Manager, Central Genetics Lab was the Chief Guest at the UGC sponsored National Seminar on 'Biosciences & Conservation' (NAB CON-14; 10-11<sup>th</sup> March, 2014), conducted by the AVC College, Mayiladuthurai, Tamil Nadu and presented the paper on "Aquaculture Genetics: Initiatives by Rajiv Gandhi Centre for Aquaculture".

❖ **Dr. Anup Mandal**, Manager, Central Genetics Lab CGL made a presentation on "Importance of mangrove ecosystem for sustainable crab production" at a Workshop organized at Moha, Taluka-Panvel, District-Raigad, Maharashtra on 21<sup>st</sup> June, 2013 by MPEDA, RO, Mumbai for the benefit of around 200 fisher folk in the area.

❖ **Dr. Anup Mandal**, Manager, Central Genetics Lab CGL made a presentation on "Aqua-silvi culture for sustainable crab production" at a Workshop organized by MPEDA, RO, Mumbai at Dhuriwada, Tal-Malvan, District-Sindhudurg, Maharashtra on 22<sup>nd</sup> June, 2013 for the benefit of over 70 fishers including fisher and fisher societies from Maharashtra.

## Ph.D Awarded

❖ **Shri. Ganesh K**, Project Manager Seabass hatchery was awarded with Ph.D degree from Centre for Advanced Studies in Marine Biology and Oceanography on the title 'Studies on larval rearing of Asian Seabass, *Lates calcarifer* (Bloch). This work was the first outcome of the collaboration between Annamalai University and RGCA in the field of research.

# Budget and Expenditure

The Sanctioned budget of Rs. 7638 Lakhs was earmarked for the projects during 2013-14, Rs. 1639 Lakhs for capital expenditure and Rs. 5999 Lakhs for recurring expenditure. The Total fund available during the financial year was Rs. 6402.28 Lakhs of which

amount spent was Rs. 884.97 Lakhs towards capital and recurring expenditure was Rs 3472.22 Lakhs. The balance fund available as on 31.03.2014 was Rs. 2045.09 Lakhs.

## RGCA Foundation (Corpus Fund)

The Ministry of Commerce and Industry had sanctioned Rs. 25 crores as RGCA foundation corpus Fund during the 11th Plan period to maintain core group of technical experts for RGCA projects and also to maintain the infrastructure facilities being developed by the centre at species specific locations across the country. RGCA formed a Corpus Fund Management Committee comprising of senior officers from RGCA and MPEDA to take decisions on the investment of the same. Accordingly the sanctioned amount of Rs. 25 crores was deposited with the State Bank of India for one year with effect from 1<sup>st</sup> April, 2008 at an interest rate of 9.50%.

During April 2013, the Corpus Fund of Rs. 25 crores plus the accrued interest amounting to Rs.39.04 crores has been deposited with the TNPF & INDC Ltd.,

at an annual interest of 9.25% for a period of one year with effect from 10<sup>th</sup> April 2013. The amount at maturity would be Rs. 42.81 crores.

During the 11<sup>th</sup> Plan period, the scope of activities at all the projects pursued by RGCA as well as at the newly initiated projects of RGCA increased tremendously necessitating acquisition and development of additional infrastructure as well as manpower and as such the income generated from the allocated corpus fund was too meagre to meet the requirements and necessitated further strengthening. Hence an additional Rs. 75 crores has been sought as corpus fund for the 12<sup>th</sup> plan period. Once this amount is sanctioned, it is proposed to meet the salary and wages component of three major projects of RGCA for three years during the 12<sup>th</sup> plan period using the income generated from the combined corpus fund.

RGCA FOUNDATION CORPUS FUND DETAILS (2013-14)	Rs. In Lakhs
RGCA Corpus Fund Deposited with Accrued Interest upto April'2013	3904.14
RGCA Corpus Fund with accrued interest as on March 2014	4280.89
Maintenance of select Core staff & Infrastructure upto March'2014	672.74
Balance Corpus fund amount available as on 31st March'2014	3608.15



# Manpower

President

Ms. Leena Nair, IAS

Project Director &  
Secretary cum Treasurer

Shri. Y.C. Thampi Sam Raj

Following Officers/Staff were on rolls at RGCA during 2013-14

S. No.	Name	Designation	S. No.	Name	Designation
<b>HEAD QUARTERS, SORKALI</b>					
1	S. Krishna Das	Chief Manager (Accounts) *	26	Ananda jothi	Asst. Tech. Manager ◊
2	Jaideep Kumar	Project Manager (Co-ord) ◊	27	G. Sathiyaraj	Asst. Tech. Manager ◊
3	A.G. Arif	Project Manager(Works) *	28	K. Karthik Kannan	Asst. Tech. Manager ◊
4	Dr. Anup Mandal	Manager-Genetics ◊	29	Sobha P.S	Technician ◊
5	V.N Biju	Asst.Project Manager *	30	Anjali K.M	Technician ◊
6	G. Rajeesh	Asst. Accounts Manager ◊	31	G.Devika Rani	Accountant ◊
7	D. Rajesh	Asst.Accounts Manager ◊	32	P. Babu	Electrician-cum-Mechanic ◊
8	B. Thiripura Sundari	Jr. Project Manager (P & A) ◊	<b>TECHNOLOGY TRANSFER &amp; TRAINING, SORKALI</b>		
9	K. Rajendran	Administrative Assistant ◊	33	V. Shanmuga Arasu	Asst. Tech. Manager ◊
10	U. Chinnadurai	Driver ◊	34	S. Elangeswaran	Asst. Tech. Manager ◊
11	K. Marieswaran	Accountant ◊	<b>SEABASS &amp; MANGROVE CRAB HATCHERY, THODUVAI</b>		
12	M. Mahadevan	Accountant ◊	35	Dr. K.Ganesh	Project Manager *
13	K. Maheswaran	Accountant ◊	36	S. Arul Raj	Assistant Project Manager *
14	K. Arumugam	Accountant ◊	37	D.Y.S. Krishnamurthy	Asst. Tech. Manager ◊
15	K. Aadhavan	Facility Manager ◊	38	M. Saravanan	Asst. Tech. Manager ◊
16	K. Muraleedharan	Project Manager (P & A) ◊	39	R. Senthil Kumar	Electrical cum Mechanical supervisor ◊
17	A. Elamaran	Asst.Project Manager (Works) ◊	40	A.S. Vasudevan	Electrical cum Mechanical supervisor ◊
18	C. Elamparuthi	Asst.Project Manager (Works) ◊	41	P.U. Sujith	Accountant ◊
19	G. Uma Maheswari	Asst.Tech.Manager ◊	42	K.V Gangadharan	Asst. Technical Manager ◊
20	B. Babu	Asst.Tech.Manager ◊	43	R. Murugesan	Asst. Technical Manager ◊
21	Mithun Raj	Asst.Tech.Manager ◊	44	K. Velmurugan	Asst. Technical Manager ◊
22	K.V. Ravikumar	Accountant ◊	45	S. Viswanathan	Technician ◊
23	Dr. L. Mohan Kumar	Asst. Librarian ◊			
24	S. John	Library Assistant ◊			
25	L. Ruban	Asst. Tech. Manager ◊			

### AQUACULTURE DEMONSTRATION FARM, KARAIKAL

46	S.Pandiarajan	Project Manager *
47	T. Sundaresan	Asst. Technical Manager ♦
48	K. Sateesh Kumar	Asst. Technical Manager ♦
49	S. Rajarajan	Accountant ♦
50	Dr. G.K Dinakaran	Asst. Technical Manager ♦

### AQUATIC QUARANTINE FACILITY FOR *L. vannamei*

51	Dr. A.K. Panda	Project Manager ♦
52	D. Kannan	Asst. Project Manager ♦
53	N. Babu Rao	Asst. Project Manager ♦
54	M.C Remany	Asst. Project Manager ♦
55	Daly Cyriac	Asst. Technical Manager ♦
56	Aswini Kumar	Asst. Technical Manager ♦
57	Erra Suresh Babu	Asst. Technical Manager ♦
58	V.Ravikumar	Asst. Technical Manager ♦
59	K. Sankar	Purchase-cum-stores Asst♦
60	V.Parthasarathy	Accountant ♦
61	Krishnakanth varada Raju	Asst. Technical Manager ♦
62	Sruthi Prem O.C.	Asst. Technical Manager ♦
63	Ashish Pandey	Technician ♦
64	K.Ganesan	Electrician-cum-Mechanic ♦
65	P.Thirunavukkarasu	Technician ♦

### SCAMPI BROODSTOCK DEVELOPMENT PROJECT, VIJAYAWADA

66	B.Narasimha Rao	Project Manager *
67	Dr. D.V.S.N Raju	Asst.Project Manager ♦
68	Dr. Johny T. Varghese	Junior Project Manager ♦
69	K. Lakshmi Narayana	Asst. Technical Manager ♦
70	B. Suresh	Asst. Technical Manager ♦
71	G. Ramu	Accountant ♦
72	Sheikh Nagoorvali	Asst. Technical Manager ♦
73	Ms.Areefa Begum	Technician ♦
74	K.K Chinthiah	Technician ♦
75	P.Srinu	Technician ♦
76	Sathishbabu Manda	Technician ♦
77	S.Kannan	Asst.Project Manager ♦

### TILAPIA PROJECT, VIJAYAWADA

78	Appala Naidu	Asst. Project Manager *
79	P. Srinivasa Rao	Junior Project Manager ♦
80	U. Gunasekaran	Asst. Technical Manager ♦
81	V. Subash	Accountant ♦
82	K. Mathews Varkey	Asst. Project Manager ♦
83	M.Gnanavel	Asst. Technical Manager ♦
84	P.S Sivakumar	Asst. Technical Manager ♦
85	G. Senthil	Technician ♦
86	Kotharu Rohini Kumar	Electrician-cum-Mechanic ♦

### ARTEMIA PROJECT, TUTICORIN

87	M.Samaya Kannan	Asst.Project Manager ♦
88	S. Balachander	Asst. Technical Manager ♦
89	S.Moovendan	Asst. Technical Manager ♦
90	T.Veeramani	Asst. Technical Manager ♦
91	J. Mohanraj	Accountant ♦

### MARINE FINFISH HATCHERY PROJECT, POZHIIYUR

92	P.Anil Kumar	Project Manager *
93	Johnson D Cruz	Asst.Project Manager *
94	K.Dhandapani	Asst.Project Manager ♦
95	V.S. Aravind	Asst. Technical Manager ♦
96	P.N. Damodar	Asst. Technical Manager ♦
97	G. Karthik	Accountant ♦
98	A.Packiaraj	Technician ♦
99	Arjunan V.M	Technician ♦
100	M.Saravanan	Asst. Technical Manager ♦

### GROUPER PROJECT, A & N ISLANDS

101	G. Elumalai	Accountant ♦
102	S.Vijayakumar	Asst. Technical Manager ♦

## RGCA – SHRIMP BREEDING PROJECTS

I 03 Dr. P. Jayagopal Project Manager \*

## DOMESTICATION OF TIGER SHRIMP PROJECT (DTSP), NBC & PPQ, ANDAMAN

I 04 D.Thinesh Santhar Project Manager ♦  
I 05 S. Nagaraj Asst. Project Manager ♦  
I 06 P. Bangaraju Asst. Technical Manager ♦  
I 07 G. Sivakrishna Asst. Technical Manager ♦  
I 08 Binod Gharami Facility Manager ♦  
I 09 K. Praveen Raj Asst. Project Manager (P&A) ♦  
I 10 M. Shailendar Asst. Project Manager ♦  
I 11 D. Silambarasan Asst. Technical Manager ♦  
I 12 Sarmal K. P Asst. Technical Manager ♦  
I 13 Boorada Kishor Asst. Technical Manager ♦  
I 14 Nayeem Fuad Accountant ♦  
I 15 Dayamay Halder Asst. Facility Manager (Elec) ♦  
I 16 P. Krishnaswamy Electrician-cum-Mechanic ♦  
I 17 R.Rajan AFM (Civil) ♦  
I 18 Sheetal Dilip Technician ♦  
I 19 John C.E Asst. Project Manager ♦

## DTSP – SBNPC PROJECT (OSSPARC)

I 20 Boyina Srikanth Asst. Project Manager ♦  
I 21 Y. Narayanaswamy Asst. Technical Manager ♦  
I 22 P. Michael Renold Bino Accountant ♦

I 23 Susanta Kumar Patra Asst. Project Manager ♦  
I 24 A. Janaki Ramaiah APM (P & A) ♦  
I 25 Haraprasad Panigraphy Electrician-cum-Mechanic ♦

## HIGH HEALTH SHRIMP SEED PRODUCTION UNIT-II, CHIRALA, AP

I 26 G. Ramar Project Manager \*  
I 27 Kanakam Suresh Technician ♦  
I 28 V. Elumalai Asst. Tech. Manager ♦  
I 29 Tammineni Srinivasa Rao Purchase-cum-Store Assistant ♦  
I 30 Kiran Pilli Technician ♦

## DTSP – L.VANNAMEI BMC PROJECT (TASPARC)

I 31 H. Dinesh Kumar Manager ♦  
I 32 Dr. A. Anand Kumar Asst. Project Manager \*  
I 33 Michael Renold Bino Accountant ♦  
I 34 Varanasi Laxmi Asst. Technical Manager ♦  
I 35 CH. Santhosh Kumar Asst. Technical Manager ♦  
I 36 Ranjan Kumar Patra Asst. Project Manager ♦  
I 37 Ratikanta Mohapatra APM (P & A) ♦  
I 38 D.Kishore Chandra Rao Technician ♦  
I 39 Lanka Gurusurthy Technician ♦  
I 40 Anish.G Purchase-cum-Store Asst ♦

♦ Regular Employee of RGCA

\* Deputation from MPEDA

★ Deputation from TASPARC

⊛ Direct Recruitment on contract basis

# Visit of Dignitaries

Dr. S. Ayyappan, Secretary, Department of Agricultural Research & Education (DARE) and Director General, Indian Council of Agriculture Research (ICAR), Ministry of Agriculture, Govt. of India visited RGCA on 8-10-2013.



Dr. S. Ayyappan with Shri. Y.C. Thampi Sam Raj at the Headquarters of RGCA



Dr. S. Ayyappan at Mud crab hatchery of RGCA



Dr. S. Ayyappan with staff of RGCA



Dr. Donald V. Lightner, Dr. Shaun Moss, Mr. Steve Arce, visiting RGCA Library



Dr. Donald V. Lightner at Central Aquaculture Pathology Laboratory



MPEDA Authority members at the Headquarters of RGCA



Dr. Eli Afalalo, Consultant, Israel at the Head Office of RGCA

# Addresses of RGCA Projects

## Administrative Complex

### Y.C. Thampi Sam Raj, Project Director

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## Seabass Hatchery Project

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## Mud Crab Hatchery Project

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## RGCA Shrimp Breeding Projects

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## Domestication of Tiger Shrimp Project (NBC)

### D. Thinesh Santhar – Project Manager

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## Pilot Scale Broodstock Multiplication Centre

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### **High Health Shrimp Seed Production Unit - Chirala**

#### **Shri. G. Ramar – Project Manager**

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### **Pre-Primary and Primary Quarantine Unit**

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### **L. vannamei Broodstock Multiplication Centre**

#### **Shri. H. Dinesh Kumar - Manager**

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#### **Shri. D. Thinesh Santhar – Project Manager**

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### **Pilot Scale Artemia Project**

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### **Aquaculture Demonstration farm**

#### **Shri. S. Pandiarajan - Project Manager**

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### **Aquatic Quarantine Facility for L. vannamei**

#### **Dr. Amiya Kumar Panda, Project Manager**

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### **Scampi Broodstock Development Project**

#### **Shri. B. Narasimha Rao, Project Manager**

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### **Tilapia Project**

#### **Shri. Jaideep Kumar – Technical Head**

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### **Marine Finfish Hatchery Project**

#### **Shri. P. Anilkumar - Project Manager**

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### **Infrastructure Development Division**

#### **Shri. A.G. Arif - Project Manager**

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### **Technology Transfer & Training Division**

#### **Shri. Jaideep Kumar – Project Manager (I/c)**

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### **Registered Office**

#### **RAJIV GANDHI CENTRE FOR AQUACULTURE**

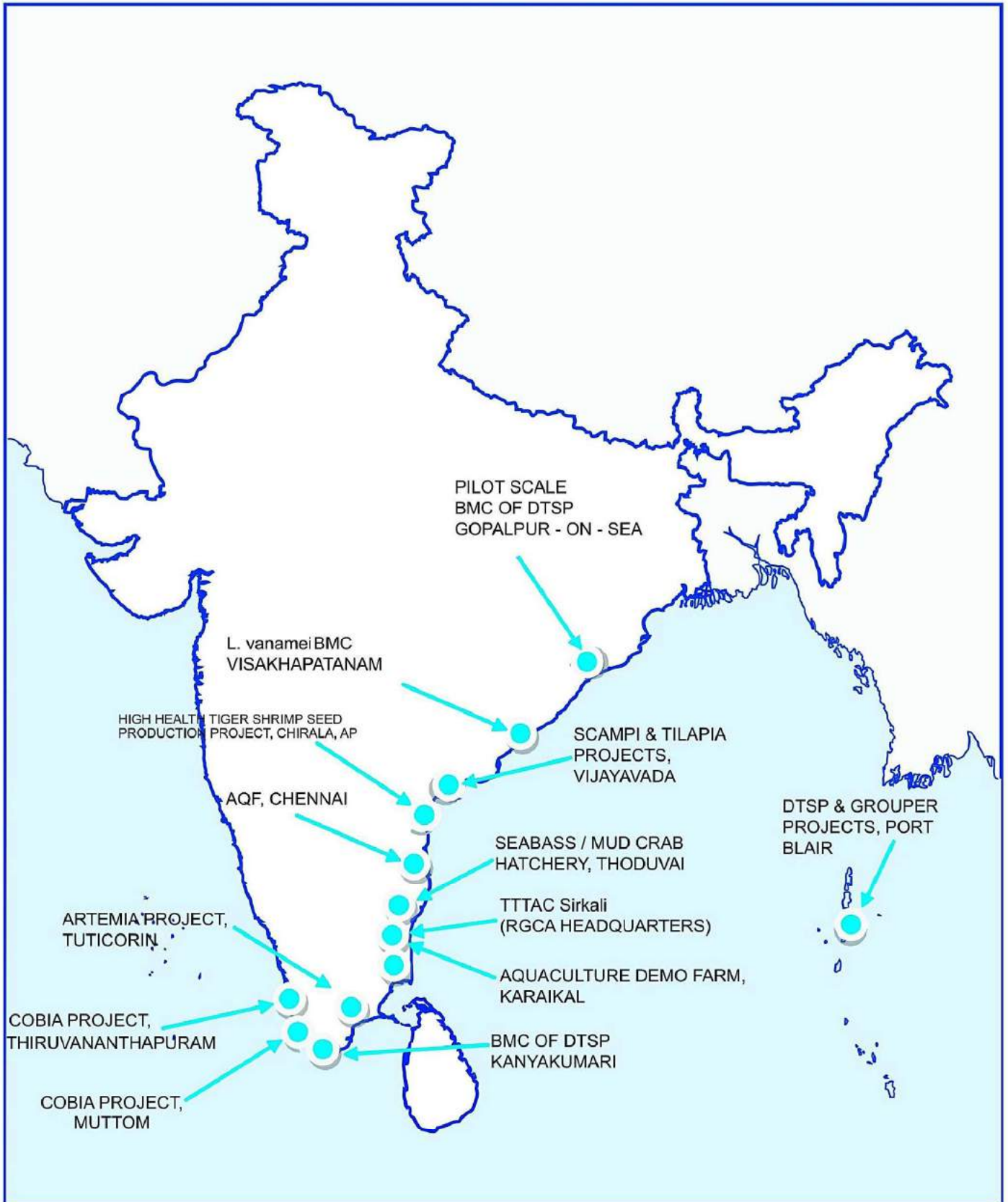
C/o The Marine Products Export Development Authority  
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## RGCA Project Locations





## Rajiv Gandhi Centre for Aquaculture

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