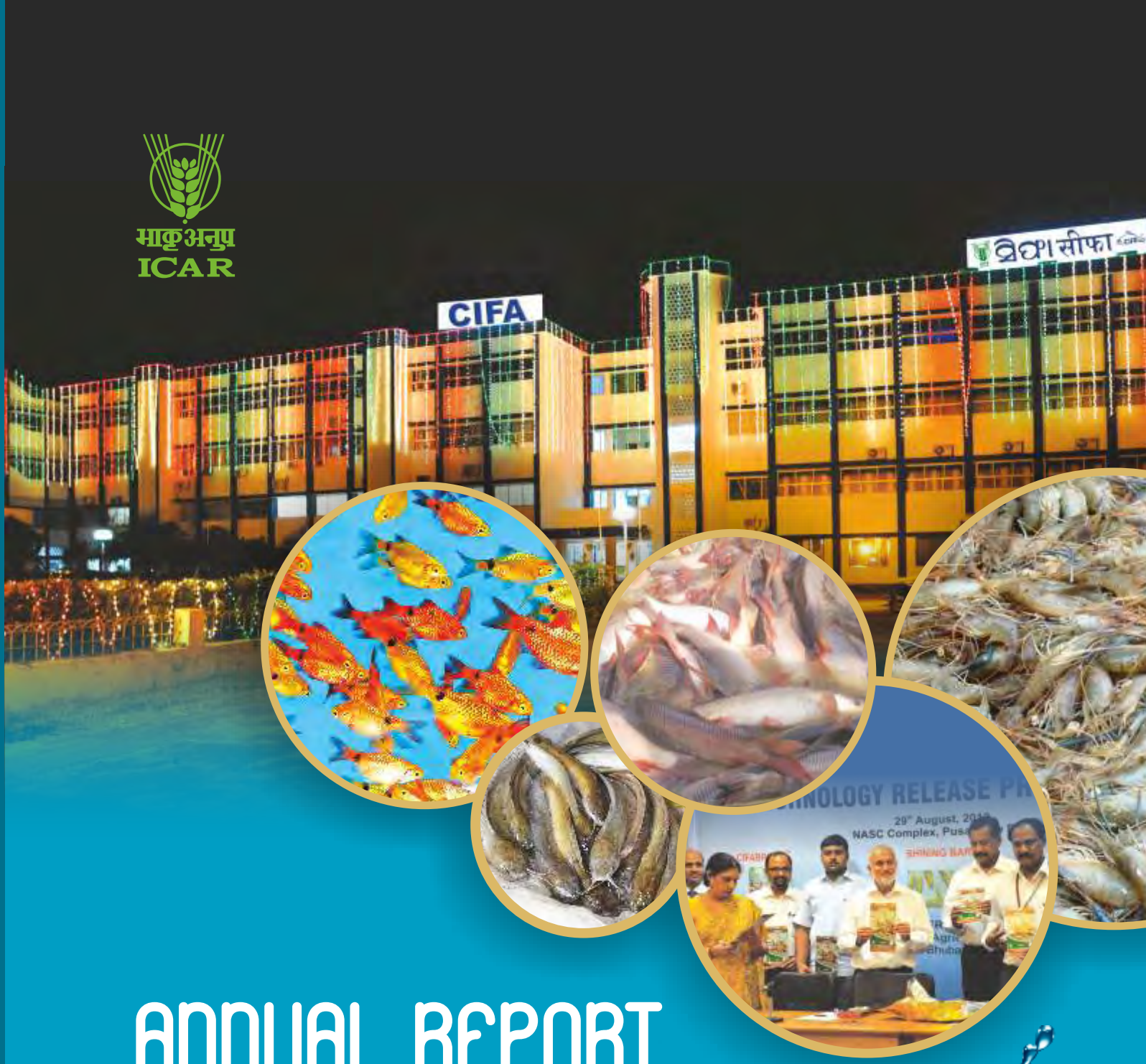
CIFA

ANNUAL REPORT

2013-14



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CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE

(An ISO 9001:2008 Certified Institution)

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CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE
(An ISO 9001:2008 Certified Institution)
(Indian Council of Agricultural Research)
KAUSALYAGANGA, BHUBANESWAR 751 002, ODISHA, INDIA

CREDIT LINE

PUBLISHER : Dr P. Jayasankar
Director, CIFA

EDITORIAL BOARD : Dr S. K. Swain (Chairman)
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COMPILATION : Mrs B. L. Dhir

PHOTOGRAPHY : Sri S. Mahali

Citation: CIFA 2014. Annual Report 2013-14. Central Institute of Freshwater Aquaculture, Bhubaneswar, India. pp 156.

ISSN: 0972-012X

PRINTED AT : **Print-Tech Offset Pvt. Ltd.**
F-66/1 & F-66/2, Chandaka Industrial Area, Bhubaneswar-24
Tel. : +91 674 - 2740737 / 2740767, E-mail : printtechbbsr@gmail.com

PREFACE

Greetings from Team CIFA

Compliments and congratulations to all those who have brought about perceptible progress in various fields during 2013-2014 to this institute, ICAR, farmers and other stakeholders. The year 2013 had ended on a satisfactory note for Indian aquaculture with good harvest of Pangas and IMCs. On the other hand, calamities like cyclones and flood created havoc in Odisha, Andhra Pradesh and other parts in the east coast of India, though alertness and the power of technologies did minimize disastrous effects considerably. On the research front 40% surrogate carp could be produced successfully by utilizing the gametes of GC recipient fish and a normal fish. Hilsa (*Tenualosa ilisha*) from Hooghly River was successfully bred by dry stripping method in at Godakhali, West Bengal by RRC, Rahara. Indigenous ornamental fish *Dawkinsia tambraparniei* was successfully bred in hatchery and larval rearing was carried out with incorporation of live feed in their diet. Induced breeding of rohu during November and its second breeding during February through photo-thermal manipulation was successfully demonstrated, thus now able to produce carp seeds round the year. About 20 lakh spawns striped catfish *Pangasianodon hypothalamus* were produced under NFDB program at RRC, Vijayawada. A new innovative concrete cistern was used for development of striped snakehead (*Channa striatus*) brooders with modification in habitat management. Tilapia breeding and variety development programme has been initiated and a total production of 3.2 ton/ha/ 6 months in mono-sex and 2.29 ton/ha/ 6 months in mixed sex culture was achieved. Success was achieved in designing a low cost indigenous freshwater pearl mussel holder, thereby adding innovation to pearl production technology. FRP carp hatchery was installed and operated in Bali, Sunderban and produced 4.0 lakhs of carp spawn in one operation. CIFA technology intervention has brought smile on the face of tribals of this region where from a bench mark production of less than 1t/ha/year, almost 5t/ha/yr carps could be produced from house hold ponds. Under NFDB funded project, in collaboration with NFFBB, 46,710 numbers of improved rohu "Jayanti" fingerlings were supplied to 11 states like West Bengal, Karnataka, Chhattisgarh, Tamil Nadu, Maharashtra, Madhya Pradesh, Odisha, Andhra Pradesh, Jharkhand, Assam and Tripura. Water quality index was prepared for aquaculture effluents from pangas culture ponds based on National Sanitation Foundation Water Quality Index (NSF WQI). Around 4395 farmers were benefitted under NAIP project on Sustainable livelihood improvement through integrated freshwater aquaculture, horticulture and livestock development. National surveillance programme on aquatic animal diseases was lunched in Odisha and Andhra Pradesh. Next generation sequencing of a portion of catla genome generated approximately 5.7MB of sequence data and 29794 contigs after assembly. Cloning and characterization of Pou2 gene was carried out in farmed rohu, *Labeo rohita*. Out of 300 monomorphic microsatellite markers initially developed in *Labeo rohita,* 20 markers were found to be monomorphic in other carp species viz. *Catla catla, Cirrhinus mrigala, Labeo fimbriatus, Labeo bata, Cirrhinus reba* and *Labeo gonius*. Expression

pattern of innate immune receptors (NLRC5, NLRX1, TLR5 and TLR22) and their downstream molecules (IRAK4, TRAF4 and IRF3) were elucidated in magur (*Clarias batrachus*) in response to abiotic stresses like heat and cold stresses. Full sequence information of P0 protein of the ectoparasite *Argulus siamensis* and the host *L. rohita* was obtained that might have role in protective immunity against *A. siamensis*. Copper oxide nanoparticles were found to reduce both microbial load as well as ammonia content of the water.

Open source library automation management software "KOHA" was successfully installed at CIFA on Debian Linux Server. Business Planning and Development (BPD) Unit was set up in CIFA in June, 2013 and has generated revenue of about Rs. 9.0 lakhs through incubation services and consultancy. Online ASRB examination system centre is fully operational now, and around 483 candidates wrote exams from 55 disciplines.

The QRT under the chairmanship of Dr K.V. Devaraj, former Vice Chancellor, University of Agricultural Science, Bangalore reviewed the last 5 year research progress and suggested many new areas for the institute to catalyze development in freshwater aquaculture sector. The new RAC headed by Dr K.K. Vaas, Formers Director, CIFRI, Barrackpore reviewed the work and suggested many new frontier areas in freshwater Aquaculture research. The research achievement of Fish Health and Management division brought laurel to the division by bagging Best Division of CIFA award. The institute could do reasonably well in ICAR sports meet; though we need to improve further to bring much more glory in sports. National Consultation on water resilient aquaculture gave a wider idea to handle the crisis in water management in the future for aquaculture expansion.

CIFA has been credited with ISO 9001:2008 certificate which would entail quality monitoring in research, administration and financial management. Other items which brought new prospects to Institute need special mention: Slogan of the year: "People and Partnership" which was mooted by KVK, Khurdha; Most high profile extension programme of the year: Bali (Sunderban, West Bengal) under Tribal Sub Plan, in which the institute has spearheaded holistic agriculture development in a remote village through technology interventions; Most significant commercialized technology: carp broodstock diet, CIFABROOD™ , which has significantly improved survival and quality of carp seeds, in addition to triggering early maturation; Most promising facility of the year: CIFA BPD under NAIP and Most effective institution building committee of the year: Farm & Campus Management Committee. I would appreciate the efforts of CIFA family for up keeping of good work to fulfill the need based demand of farming community, entrepreneurs and other stake holders.

The editorial committee headed by Dr S.K. Swain and members like Dr J.K. Sundaray, Dr S. Adhikari, Dr B.K. Das, Dr K.C. Das, Shri N. K. Barik, Dr Rajesh Kumar, Dr Sailesh Saurab and Dr D.K. Verma have done a commendable job to finish the assignment on time. We are grateful to Secretary, DARE and Director General, ICAR, Dr S. Ayyappan for his constant guidance and support to improve the quality of research and to enhance the scientific productivity, which would pave the way for aquaculture development. We are thankful to Dr (Mrs.) B Meenakumari, DDG (Fishery Science), Dr S.D. Singh ADG (Inland Fishery) and Dr Madan Mohan ADG (Marine Fishery) for their continuous encouragement and support to continue the farmers oriented research for sustainable development of freshwater aquaculture in the region.

Dr P. Jayasankar
Director

CONTENTS

EXECUTIVE SUMMARY

1.	Name & Address of the Institute	:	**Central Institute of Freshwater Aquaculture** Kausalyaganga, Bhubaneswar 751 002 Odisha, India
	a) Headquarters	:	Kausalyaganga, Bhubaneswar 751 002 Odisha
	b) Regional Centres	:	i) **Regional Research Centre** Rahara Fish Farm, Rahara 743 186, West Bengal (Field Station of RRC, Rahara: A/5, Phase-III Santhalpara, Nadia, Kalyani 741 235, West Bengal)
			ii) **Regional Research Centre** Hessarghatta Lake, Bengaluru 560 089, Karnataka
			iii) **Regional Research Centre** Penamaluru Fish Seed Farm, Penamaluru, Vijayawada 521 139, Andhra Pradesh
			iv) **Regional Research Centre** ATIC, Anand Agricultural University, Borsad Chowkadi, Anand 388001, Gujarat
	c) KVK	:	**Krishi Vigyan Kendra** Kausalyaganga, Bhubaneswar 751 002 Odisha

2. Budget (2013-14)

a) Institute (Rs. in lakhs)

Plan		Non-Plan					
Provision	Expenditure	Govt. Grant	Allocation internal + additional amount provided by Hqrs out of council's share	Total allocation (col 3+4)	Exp. out of Govt. Grant	Exp. out of revenue generation	Total Exp. (col 6+7)
1	2	3	4	5	6	7	8
744.00	741.70	2197.94	149.11	2347.05	2105.18	149.11	2254.29

b) External Sources (Rs. in lakhs)

Source	Amount
BTIS	0.39
Pension & other retirement benefits	129.01
ICAR/APA/IPR/NFBSFARA/KVK/NAIP (Plan Scheme)	638.06
Non-plan Scheme	63.93
P Loans & Advances	10.77
Externally funded projects	29.04
Total	**871.20**

c) Revenue generated (2013-14) (Rs. in lakhs)

Source	Amount
Farm produce	5.54
Sale of fish and poultry	12.83
Sale of vehicle/other machine tools	2.21
Sale of publications	0.13
Licence fee/water charges	5.60
Analytical testing fee	0.28
Cost of tender forms	1.25
Services render	4.93
Training	7.03
Miscellaneous	5.56
Interest on loans and advances	16.65
Interest on TDR	27.80
Others (Royalty, & Instt. Charges)	0.36
Total:	**90.17**

3. Staff Position (as on 31.3.2014)

Category	Sanction	Position	Vacant
Scientific			
Director	1	1	-
HoD	4	3	1
Principal Scientist	2	-	2
Senior Scientist	12	10	2
Scientist	60	40	20
Total:	**79**	**54**	**25**
Category (Technical)			
T-6	3+1	0	3+1
T-3	23	14	9
T-2	3	3	0
T-1 (including Driver)	21	17	4
Total:	**51**	**34**	**17**
Category (Administrative)			
Sr. Administative Officer	1	-	1
A.O.	1	1	-
F&A.O.	1	1	-
A.A.O.	5	3	2
AF&A.O.	1	1	-
Security Officer	1	1	-
P.S.	1	1	-
P.A.	3	3	-
Assistant	10	6	4
U.D.C.	6	6	-
Junior Steno	1	-	1
L.D.C.	6	3	3
Total:	**37**	**25**	**12**
Supporting			
Skilled Support Staff	120	91	29
Total:	**287**	**204**	**83**

Staff Position of KVK (as on 31.3.2013)

Category	Sanction	Position	Vacant
Scientific			
Programme Coordinator	1	1	-
Technical			
Subject matter specialist	6	4	2
Programme Assistant	3	2	1
T-1 (Driver)	2	2	-
Administrative			
Assistant	1	-	1
Junior steno	1	-	1
Supporting			
Skilled support staff	2	2	-
Total:	16	11	5

4. Research Projects

a) Institute-based : 13

b) Externally-funded : 30

5. Training programmes conducted

Level	No. of Programmes	No. of Participants
National	20	597
International	-	-

6. Manpower development

a) No. of persons trained at national level : 13

b) No. of persons trained at international level : 02

7. Workshops organized

National : 5

International : 1

8. Participation in symposia/seminars/workshops, etc.

Level	No. of Participants
National	46
International	03

9. Infrastructure development

- Renovation of VG Jhingran Auditorium at CIFA, Kausalyaganga
- Construction of boundary wall at CIFA, Kausalyaganga
- Renovation of 80,000 gallon capacity overhead tank at CIFA, Kausalyaganga
- Renovation of type III and IV residential quarters at CIFA, Kausalyaganga
- Construction of new BPD Office
- Construction of technology park under BPD CIFA
- Construction of Tilapia hatchery under BPD CIFA
- Construction of 3 nos of ponds under BPD CIFA

10. Salient Research Achievements

- About 40% surrogate carp could be produced successfully by utilizing the gametes of GC recipient fish and a normal fish.
- Striped snakehead (*Channa striatus*) brooders were developed in concrete cisterns with help of proper diet and habitat management. Induced captive breeding of the fish was performed with HCG and PG extract yielding fertilization and hatching rates of 80-99% and 75-90%, respectively.
- Indigenous ornamental fish, *Dawkinsia tambraparniei* was successfully bred in hatchery and larval rearing was carried out with incorporation of live feed in their diet.
- Research results revealed that the density and duration of seed stunting in rohu did not to have any compensatory growth implication in the subsequent grow-out culture in both monoculture as well as in polyculture.
- Study has shown that the growth, biomass production per m^3 of tilapia (*Oreochromis niloticus*) declined with increase of height of silo.
- Breeding and larval rearing of *Macrobrachium malcolmsonii* was conducted successfully in 20 ppt brackish water by adopting conventional clear water technique with water exchange system.

- Tilapia breeding and variety development programme has been initiated and a total production of 3.2 ton/ha/ 6 months in mono-sex and 2.29 ton/ha/ 6 months in mixed sex culture was achieved.
- Successful Induced breeding of *Mystus gulio* through hypophysation was achieved at Kalyani Field Station.
- About 20 lakh spawns striped catfish *Pangasianodon hypothalamus* were produced under NFDB program.
- *Macrobrachium rosenbergii* brood bank was established at College of Fisheries Farm, Nellore and technical guidance was provided to culture prawn up to viable brood stock for seed production.
- Hilsa (*Tenualosa ilisha*) from Hooghly River was successfully bred by dry stripping method at Godakhali.
- Water quality index was prepared for aquaculture effluents from pangas culture ponds based on National Sanitation Foundation Water Quality Index (NSF WQI).
- Study revealed that gypsum was more effective than lime in reducing the phosphorus content in water.
- Success was achieved in designing a low cost indigenous freshwater pearl mussel holder.
- Alternative gel based food as a substitute for high value live food was developed for *Macrobrachium rosenbergii* larvae.
- A marketing hub was established at Barkote with cement tanks and pet shop for easy trading of ornamental fishes run by Tulasi Marei, a tribal lady.
- FRP carp hatchery was installed and operated in Bali and produced 4.0 lakhs of carp spawn in one operation. Further, compared to bench mark of 0.8t/ha/crop production of 3.8t/ha/year could be achieved. Bali model has attracted wide attention as a successful case of livelihood support programme in tribal belt.
- Four on-farm testing of 4th generation of selectively bred *Macrobrachium rosenbergii* was carried out in four farms in Odisha. 5th Generation (G5) of selectively bred *M. rosenbergii* was also produced.
- The murrel grow out farming was well demonstrated in Khurda and Nayagarh Districts of Odisha with average production of about 2.0 t/ha/yr.
- Around 4395 farmers were benefitted under NAIP project on Sustainable livelihood improvement through integrated freshwater aquaculture, horticulture and livestock development.
- Poly-tent drier for fish was designed and developed.
- Integrated farming model with high value crops (baby-corn, sunflower, hot season tomato) with fish was developed at Kalyani Field Station.
- Value added products Fish Cracker was developed from medium and small indigenous fish species.
- Evaluation of susceptibility of *Labeo fimbriatus* fry, fingerlings and adults to Argulus revealed that adult tolerates challenge with up to 1800 metanuaplii/ fish and an infective dose of 2000 per fish is lethal.
- Molecular characterization and expression analysis of Δ-6 fatty acyl desaturase has been elucidated in the freshwater carp, *Puntius gonionotus*.
- Next generation sequencing of a portion of catla genome generated approximately 5.7MB of sequence data and 29794 contigs after assembly.
- Cloning and characterization of Pou2 gene was carried out in farmed rohu, *Labeo rohita*.
- Out of 300 monomorphic microsatellite markers initially developed in *Labeo rohita,* 20 markers

were found to be monomorphic in *Catla catla, Cirrhinus mrigala, Labeo fimbriatus, Labeo bata, Cirrhinus reba* and *Labeo gonius*.

- Research revealed the adequacy of 35% crude protein diet for *Puntius carnaticus* fingerlings.
- Raw TOC incorporation at 10% had no adverse effect on growth and survival of rohu fingerlings.
- Best quality floating feed could be prepared from ingredients by maintaining temperature of 130 or 150^{0}C and total moisture level of 20 to 22%.
- Two *Kiss* genes key modulators of reproduction in mammals were characterized in *Labeo rohita*.
- Study has shown that *Achromobacter xylosoxidans* can remove 80 μg/l of ammonia in 8 days and *E. cloacae* could remove 90 μg/l of ammonia in 12 days after application of biofloc.
- Research revealed that rohu TLR22 was closely related to common carp TLR22.
- Expression pattern of innate immune receptors (NLRC5, NLRX1, TLR5 and TLR22) and their downstream molecules (IRAK4, TRAF4 and IRF3) were elucidated in magur (*Clarias batrachus*) in response to abiotic stresses like heat and cold stresses.
- Full sequence information of P0 protein of the ectoparasite *A. siamensis* and the host *L. rohita* was obtained that might have role in protective immunity against *A. siamensis*.
- Copper oxide nanoparticles were found to reduce both microbial load as well as ammonia content of the water.
- Mx expression *in vivo,* in rohu, catla and mrigal was carried out.
- PCR primers were designed to amplify virulence associated genes (aerolysin, hemolysin, GCAT, lipase, serine protease, OMP, Act, Elastase, gyrase-B) of *Aeromonas hydrophila*.
- In rohu, immunoglobulin M, B-cell Activating Factor and CD22 genes were partially cloned and sequenced.
- National surveillance programme on aquatic animal diseases was carried out in Odisha and Andhra Pradesh and it was found that parasitic diseases like *Argulosis* and bacterial septicaemia are most prevalent diseases in farmer's ponds.
- A digital archive of institute based publications was created by converting various types of institute based publication into electronic format and storing them into the database.
- E-Learning on carp feed that will provides information on fish feeds and answers on farmers quarries was developed for knowledge dissemination programme.
- Socio-economic development and empowerment of women through aquaculture intervention produced a net income of Rs. 41,000/- during 2013-14 which contributed to the livelihood and nutritional security of about 100 women beneficiaries in the selected villages of Puri and Khordha distict.
- Open source library automation management software “KOHA” was successfully installed at CIFA on Debian Linux Server.
- Business Planning and Development (BPD) Unit was set up in CIFA in June, 2013 and has generated revenue of about Rs. 9.0 lakhs through incubation services and consultancy.
- Online ASRB examination system centre is fully operational now, and around 483 candidates wrote exams from 55 disciplines.
- Demonstrations on carp seed rearing from fry (1.57 lakhs) to fingerlings were carried out in Anand and Kheda districts of Gujarat with two beneficiaries and 68% survival was achieved.

INTRODUCTION

Mandate

With a view to give proper direction and attention to such areas of research that would enable development of freshwater resources to obtain increased yield per unit area, thereby leading to higher aquaculture production from the culturable/reclaimable ponds and tanks in the country, the following is the revised mandates of CIFA.

- To conduct basic, strategic and applied research in freshwater aquaculture;
- To enhance production efficiencies through incorporation of biotechnological tools;
- To undertake studies on diversification of aquaculture practices with reference to species and systems; and
- To provide training and consultancy services

Brief History

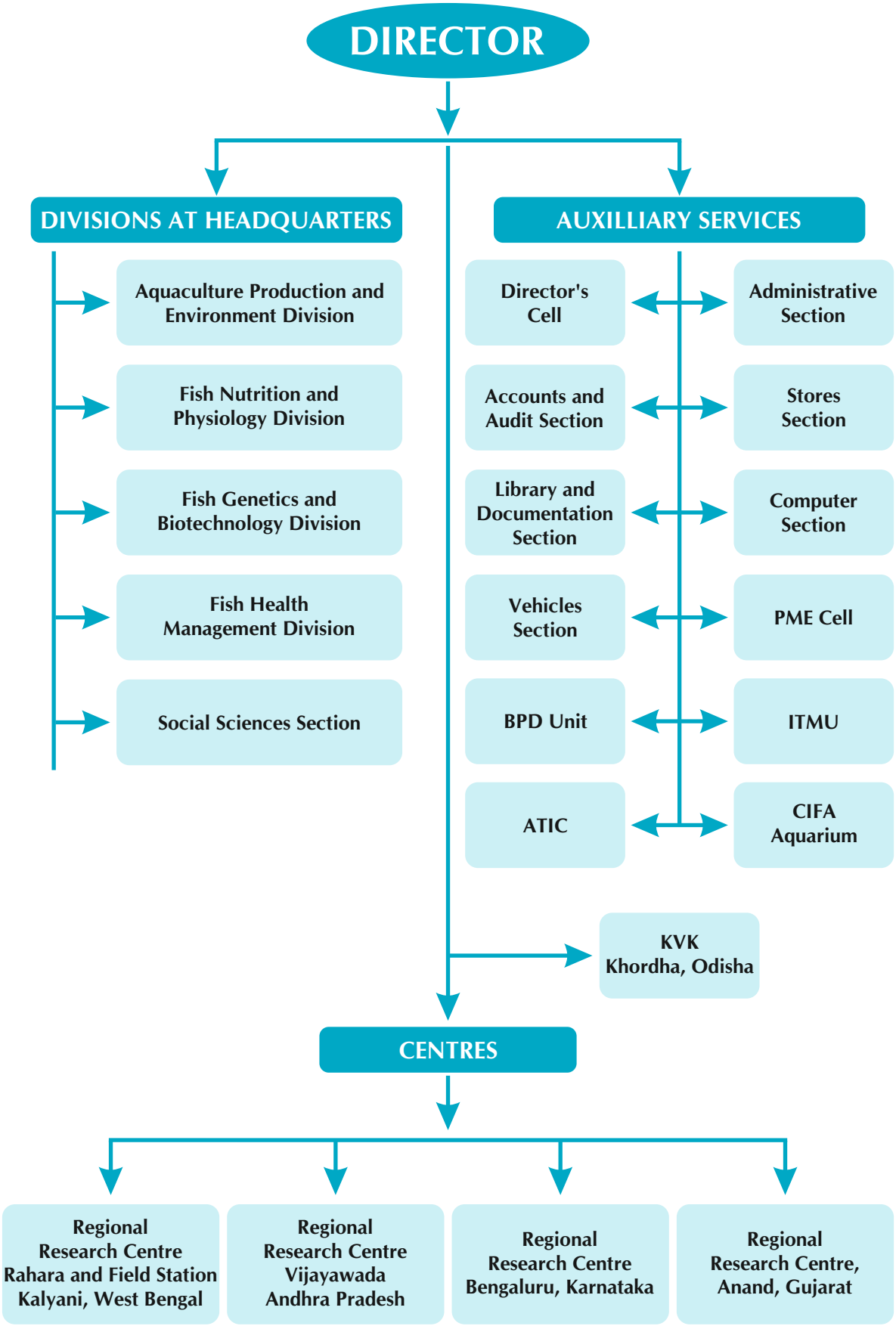
The Central Institute of Freshwater Aquaculture had its beginnings as the Pond Culture Division of the Central Inland Fisheries Research Institute, which was established at Cuttack, Odisha in 1949. The Division was later upgraded as the Freshwater Aquaculture Research and Training Centre (FARTC) established at Bhubaneswar in 1976 with UNDP/FAO assistance. Further, the Centre attained the status of an independent Institute under the organization plan of ICAR during 1986, and the functional existence of the Institute came into effect from 1st April, 1987.

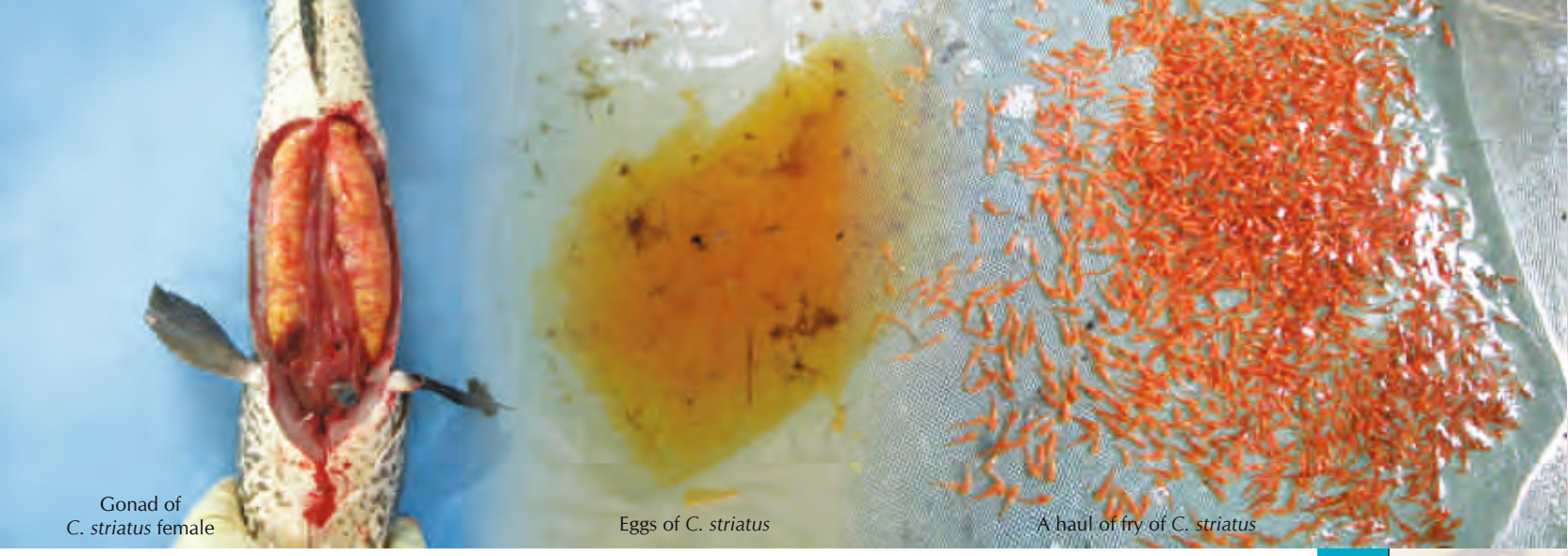
The Institute has a comprehensive mandate of research, training, education and extension in different aspects of freshwater aquaculture. With the largest freshwater farm comprising over 380 ponds of assorted sizes and yard facilities in the country at Kausalyaganga, Bhubaneswar, the Institute is undertaking researches on carps, catfishes, freshwater prawns and molluscs. The Institute possesses fully equipped laboratories in the disciplines of finfish and shellfish breeding, aquatic chemistry, microbiology, fish physiology, nutrition, genetics, biotechnology, pathology, ornamental fish breeding and culture, engineering, economics, statistics and extension.

The Institute has four Regional Research Centres operating in different parts of the country to cater to the specific needs of the regions viz. Regional Research Centre, Rahara (West Bengal); Regional Research Centre, Bengaluru (Karnataka); Regional Research Centre, Vijayawada (Andhra Pradesh) and Regional Research Centre, Anand (Gujarat).

The Institute is recognized as the Regional Lead Centre on Carp Farming under the Network of Aquaculture Centres in Asia-Pacific (NACA), which is an intergovernmental organization. A Depository Library of the Food and Agricultural Organisation (FAO) of the United Nations is also operational at the Institute. The CIFA works closely with many government organsations like Department of Animal Husbandy, Dairy and Fisheries (DAHD&F) and National Fisheries Development Board (NFDB) of Government of India.

CIFA ORGANOGRAM





Gonad of *C. striatus* female

Eggs of *C. striatus*

A haul of fry of *C. striatus*

RESEARCH ACCOMPLISHMENTS

A. Aquaculture Production and Environment

Project Title	:	Diversification in freshwater aquaculture for sustainable production
Sub-project	:	Captive breeding of stripped snakeheads Channa striatus for seed production
Project code	:	I-54 (p)
Funding Agency	:	Institute-based
Duration	:	April 2011 – March 2014
Project Personnel	:	Rajesh Kumar (PI), Kuldeep Kumar (up to March 2013), A. K. Sahu (up to September 2013) and U. L. Mohanty

Gonad examination

Round the year gonadal examination was carried out for striped snakehead brooders developed in concrete cisterns. During breeding season (June-August) the GSI for female and males were in the range of 3.91-4.31 and 0.15-0.20, respectively (Fig. 1).

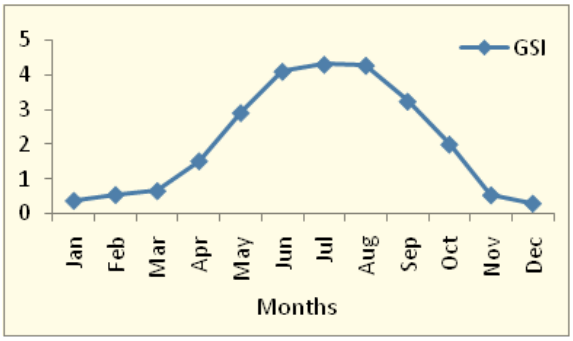


Fig. 1. Round the year GSI of female striped snakehead

Captive breeding of striped snakehead

Striped snakehead brooders were developed in concrete cisterns with help of proper diet and habitat management. These brooders were implanted with sustained hormone pellets which showed better maturity and gonad synchronization for both male and female fish. Induced captive breeding was performed for number of sets with HCG and PG extract. The fertilization and hatching rates in different sets were ranged between 80-99% and 75-90%, respectively. During 2013, more than one lakh of hatchlings were produced through induced breeding in hatchery condition.

Effect of stocking density on spawn growth and survival

An experiment was conducted to know the effect of stocking density on growth and survival of striped snakehead spawn. The highest growth and survival of spawn was achieved at stocking density of 2500 nos/m^3 of water.

Project Title	:	Sustainable freshwater aquaculture
Sub-project title	:	Breeding and larval rearing of *Puntius tambraparniei* Silas, 1954 an indigenous ornamental fish from the Western Ghats of India
Project code	:	I-80(a)
Funding Agency	:	Institute-based
Duration	:	April 2012 – March 2015
Project Personnel	:	Rajesh N. (PI) and S. K. Swain

Breeding of Tambraparniei in captivity and successfully bred

Dawkinsia tambraparniei (Silas 1954), an endangered indigenous ornamental fish from Tambraparniei River (TN) was collected second time during the month of May from one of the tributaries of the river at Thirunelveli. The water quality parameters of the collection site were found to be the temperature 28°C pH 7.4, alkalinity 45 ppm and ammonia 0.252 ppm. The fishes were maintained in indoor cement tanks with aeration under the shade net facility. Water quality parameters in the tanks were measured as temperature 30-32°C, pH 7.5-7.8, alkalinity 126-150 ppm and ammonia <0.15 ppm for better growth and survival. Spirulina enriched protein pellets and live foods (artemia, tubifex, zooplanktons like cladocerans) were fed for developing brooders in captivity.

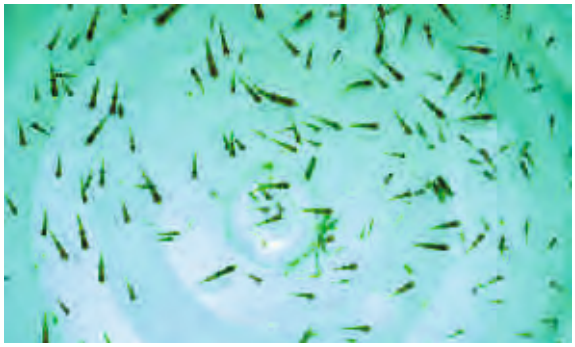
The fishes were successfully bred in the hatchery facility of CIFA during the month of August-October. Larval rearing was done successfully in the ornamental fish culture unit for a period of three months. The fishes were readily mature in captivity for a period of one year of rearing. Brooders of two year old were observed to be more productive compared to one year old brooders.

Feeding with different live food organisms

To evaluate the preference and acceptability of live food, Juveniles were fed with artemia, tubifex and zooplankton for a period of 60 days. Fishes maintained with zooplankton shows better growth and survival compared to artemia and tubifex. Mortality was more in artemia fed juveniles than the other two live food organisms. Fishes fed with tubifex were more colourful compared to zooplankton and artemia.

Growth evaluation under different environmental condition

Two sets of indoor and outdoor tanks were used for growth study in triplicate for three months. Each tank was stocked with 30 individuals. The fishes were fed with spirulina enriched floating pellets (protein: 30% d.w.). Fishes in outdoor tank showed better results compared to indoor tanks. The formation of algae and other naturally growing micro-organisms promoted growth and survival of fishes in outdoor tanks compared to indoor tanks.



Sub-project title	:	Germ cell proliferation in deficient gonads after cellular transplantation and maturation in carps
Project code	:	I-80(b)
Funding Agency	:	Institute-based
Duration	:	April 2012 – March 2015
Project Personnel	:	P. Routray (PI), A. K. Sahu (upto 30.9.2013), S. Nandi and D. K. Verma

Gonadal regression and depletion of germ cells in carps by different methods and xenogenic transplantation of germ cell in carps and surrogate fish production

This study demonstrated that elevated fish rearing water temperatures beyond 34°C gonadal regression occurred that was evidenced by reduction in gonad size GSI (Figs. 2&3). The pattern of regression was similar in male and female rohu which suggest that the endogenous GC depletion was highly influenced by the elevated water temperature where the fish were reared. The gonadosomatic index of rohu males was reduced significantly as the temperature of water increased from 28°C to 36°C. Further, successful xenogenic transplantation of germ cells was conducted in carps for the first time. Rohu GCs were transplanted into catla and vice versa. After the fish attained maturity, they were bred with each other i.e., Rohu (transplanted with GC of catla) x rohu female (normal

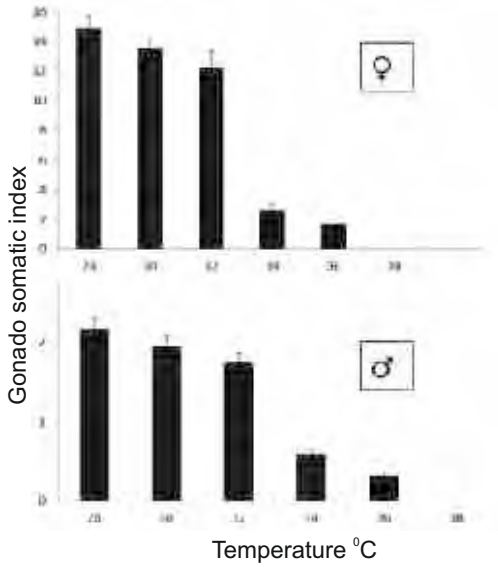


Fig. 2. Effect of different water temperatures on the gonado-somatic index of rohu, *Labeo rohita*.

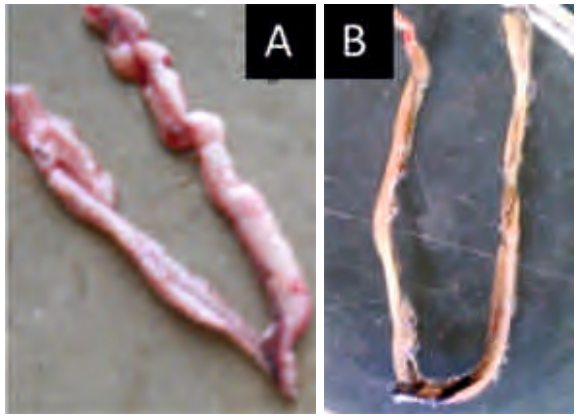


Fig. 3. Excised gonad of *Labeo rohita* showing fullness of testis before and after Busulfan administration and elevated water temperature and shrunken stage after treatment. A. before treatment (control) and B. after treatment.

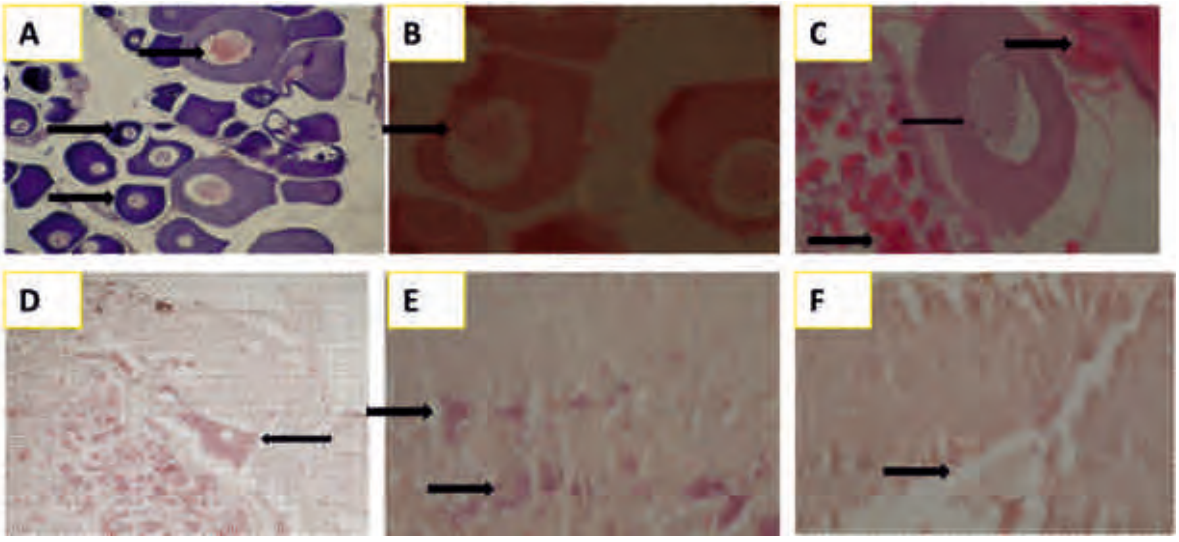


Fig. 4. H&E sections of gonads of rohu, Labeo rohita before and after treatment. A. control ovary with oocyte at various stages of development, cyst of oogonia, B. fewer oocytes and degenerating oogonia characterized by dense eosin staining, C,D,E. showing active spermatogenesis with cyst of germ cell containing spermatogonia, spermatocytes & spermatids in testicular lumen, F. lack of germ cells after booster dose of Busulfan with elevated temperature. Arrows show the area of interest in each panel.

without transplant) and vice versa. Similarly, a normal breeding was conducted between catla male (that received GC from rohu) and catla female. The offspring produced was that of either a hybrid or a normal catla or rohu. This research breakthrough has confirmed that donor derived gametes can be produced in a related host species (carp to carp). In the second year of the experiment and the results were also further confirmed that xenogenic transplantation of GC could be successful and donor derived gametes were produced in male and female carps of rohu and catla. However, the fishes transplanted with GC from other species in the first year could give less doner derived gametes than the previous year. This finding also needs further investigation about the colonization potential and host-graft relationship. Further, utilizing the gametes of these GC recipient fish and a normal (non-recipient male or female) nearly 40% surrogate carp could be produced successfully.

Sub-project title	:	Protocol development for production of stunted carp seed and study of their compensatory growth response in culture system
Project code	:	I-80(c)
Funding Agency	:	Institute-based
Duration	:	April 2012 – March 2015
Project Personnel	:	P. C. Das (PI), K. N. Mohanta, B. Mishra and B. K. Pati

Grow-out culture of stunted rohu fingerling under monoculture to evaluate the influence of duration and density of stunting on their production performance

Fingerlings of rohu stunted at 20 and 40/m^2 density for 2, 4, 6, 8, 10 and 12 months were stocked in six earthen ponds of 0.09 ha each with 720 fingerlings / pond (8000 fingerlings/ha). Each pond contained 50% of stock stunted at 20/m^2 and 50% stunted at 40/m^2. Among these stocks, 15 fingerlings from each density were tagged with electronic tag prior to their release in the pond so as to monitor the individual growth. All these fishes were reared subsequently for 12 months and their growth performance was recorded through monthly sampling.

After 12 months of grow-out culture of each stunted duration group (Table 1), the study revealed similar type of length and weight gain in all the stunted groups irrespective of their duration of seed stunting. However, seed stunted at 40/m^2 density in all duration groups showed only marginal and non-significant increase in growth compared to those stunted at 20/m^2. Absence of any convergence of the growth curves with regard to seeds with varied stunting duration revealed absence of compensatory growth capability in this species. Such results revealed the density and duration of seed stunting in rohu not to have any compensatory growth implication in the subsequent grow-out culture.

Grow-out culture of stunted rohu fingerling under polyculture to evaluate the influence of duration and density of stunting on production performance

Fingerlings of rohu stunted for 2-12 month at 20 and 40/m^2 densities were stocked along with catla and mrigal under a grow-out polyculture study in a 0.09 ha earthen pond. Catla, rohu and mrigal were stocked at 3:4:3 ratio at a combined density of 8000 fingerlings/ha. The rohu fingerlings stocked in the pond consisted of 2 month stunted population, 50% of which were stunted at 20/m^2 and the rest at 40/m^2 density. Among these, 10 fingerlings from each density were tagged with electronic tag prior to their release. Subsequently in every two months, 20 number of non-tagged rohu from the pond were replaced with 10 tagged rohu from two densities and drawn from population of 4, 6, 8, 10 and 12 months stunted groups. The grow-out study continued for two years so as to allow every stunted group of rohu to have at least 12 months grow-out culture. Sampling of the three species is being carried out at monthly intervals. From the catla and mrigal stock, 25 fishes from each species are being sampled to record their length and weight. Similarly, 25 non-tagged rohu and all tagged individuals from different stunting duration groups were sampled every month to keep the record of their growth.

During the subsequent polyculture, no convergence of growth curves was observed

among rohu stunted for greater duration (4-12 months) as compared to the two months stunted group. All the stunting duration groups showed almost similar growth performance depending on their grow-out culture duration (Table 2), but irrespective of their duration of seed stunting. Besides, there was no growth difference between the fingerlings stunted at the two densities in any of the stunting duration group. Such results, similar to our findings in monoculture, reiterated absence of any compensatory growth implication of the stunted seed with regard to duration of seed stunting in the subsequent grow-out culture.

Evaluation of growth performance of stunted versus normal fingerling in grow-out monoculture of rohu

In the earlier two mono- and poly-culture studies, the need to use rohu seed from the same population for stunting has led to stocking of grow-out ponds at different times of year only after completion of the 2-12 months stunting duration. There was a need to refine our findings of the absence of the compensatory growth in these studies against the seasonal effect, if any, that might have interfered during the growth of the stunted seed stocked at different times of the year. Therefore, another study was designed which aimed to evaluate the grow-out performance of rohu fingerlings stunted at 40/m^2 density for 12 month against same size normal fingerlings, to re-examine the compensatory growth process in the stunted individuals. Ponds (0.09 ha) have been stocked at 8000 fingerlings/ha where the stock comprised 50% each of stunted and normal fingerlings. Twenty five fingerlings from each group were tagged with electronic tag. Growth performance of fishes is being studied through monthly sampling.

Table 1. Length and weight attainment and survival of rohu in monoculture pond with stocking of seed stunted for varied duration and density

Stunted Group	Category of Stunted Seed	Length (cm) during culture			Weight (g) during culture			Survival (%)
		Initial	6 months	12 months	Initial	6 months	12 months	
2 months stunted seed	20/m^2 (Tag)	9.0±0.5	31.3±1.1	37.0±1.6	7.9±1.5	386.3±50.6	639.3±97.4	85.6
	40/m^2 (Tag)	9.3±0.6	32.3±1.5	38.2±2.7	8.4±1.5	407.5±46.2	707.5±162.4	
	All rohu	8.8±0.4	31.7±1.7	37.6±2.8	7.8±0.8	383.3±64.7	682.6±174.9	
4 months stunted seed	20/m^2 (Tag)	10.0±0.6	33.1±1.0	39.9±2.0	10.1±1.6	441.1±48.6	782.2±122.6	91.4
	40/m^2 (Tag)	10.0±0.6	33.5±1.5	40.0±1.7	10.7±1.9	462.7±60.7	789.6±109.0	
	All rohu	10.0±0.7	32.8±1.9	39.7±1.6	10.6±2.0	421.3±75.7	772.4±99.8	
6 months stunted seed	20/m^2 (Tag)	12.0±0.9	30.3±3.0	34.5±1.7	17.9±4.2	328.0±50.6	527.6±79.8	86.5
	40/m^2 (Tag)	11.8±1.1	29.9±1.2	35.0±1.7	16.8±4.2	342.9±44.2	556.1±80.2	
	All rohu	12.3±0.7	30.6±2.5	34.9±2.3	19.8±2.9	365.9±92.8	549.4±122.8	
8 months stunted seed	20/m^2 (Tag)	11.8±0.7	27.4±1.0	34.2±1.6	16.7±3.1	244.3±26.9	481.1±46.1	91.9
	40/m^2 (Tag)	10.8±0.3	28.7±0.9	35.2±1.6	13.4±1.2	282.7±30.3	507.0±60.1	
	All rohu	11.2±0.6	28.7±2.1	35.1±2.6	14.6±2.4	283.6±57.8	512.5±77.9	
10 months stunted seed	20/m^2 (Tag)	11.7±0.5	25.4±1.2	33.4±1.5	15.1±1.7	198.7±22.8	459.5±55.5	93.8
	40/m^2 (Tag)	11.3±0.4	26.8±1.2	34.8±1.4	13.5±2.0	226.9±28.6	513.5±64.8	
	All rohu	11.5±0.5	26.5±2.2	35.3±1.6	14.0±1.9	230.4±57.2	514.7±81.0	
12 months stunted seed	20/m^2 (Tag)	13.9±0.5	27.5±1.1	33.8±1.3	24.4±1.0	238.7±29.3	447.8±47.1	96.3
	40/m^2 (Tag)	12.7±0.4	27.5±0.9	34.8±1.5	20.6±2.1	241.5±23.4	482.9±82.0	
	All rohu	13.2±0.7	27.4±1.6	35.5±1.7	22.8±3.3	241.8±40.5	502.8±64.7	

Table 2. Length and weight attainment of rohu in polyculture pond with stocking of seed stunted for varied duration and density

Stunted Group	Category of Stunted Seed	Length (cm) during culture			Weight (g) during culture		
		Initial	6 months	12 months	Initial	6 months	12 months
2 months stunted seed	20/m^2 (Tag)	8.9±0.6	29.8±2.0	33.7±4.2	8.3±1.7	322.6±89.2	497.7±114.8
	40/m^2 (Tag)	9.3±0.5	29.9±1.6	34.8±1.8	8.7±2.0	348.5±64.4	506.7±93.3
4 months stunted seed	20/m^2 (Tag)	10.0±1.0	26.8±1.3	32.6±1.9	10.6±3.4	232.8±33.8	411.2±81.3
	40/m^2 (Tag)	9.9±0.6	27.5±1.1	33.1±1.3	10.4±2.0	245.3±35.8	429.1±55.6
6 months stunted seed	20/m^2 (Tag)	12.0±0.8	26.4±1.0	33.3±1.4	20.1±2.2	214.7±20.7	441.5±64.2
	40/m^2 (Tag)	11.5±1.1	25.9±0.4	35.5±1.0	15.4±4.7	219.2±15.7	452.5±47.2
8 months stunted seed	20/m^2 (Tag)	11.6±0.5	23.7±1.2	32.6±1.0	16.0±1.7	159.4±22.7	420.5±43.6
	40/m^2 (Tag)	11.2±0.4	25.2±0.9	33.0±0.8	14.2±1.3	184.9±20.7	433.0±41.2
10 months stunted seed	20/m^2 (Tag)	11.7±0.4	24.2±1.5	33.4±1.0	15.0±1.6	166.1±29.0	446.6±38.3
	40/m^2 (Tag)	11.5±0.5	26.0±1.5	34.2±0.9	11.7±2.5	206.7±34.9	483.3±30.1
12 months stunted seed	20/m^2 (Tag)	14.7±0.5	23.4±0.6	34.3±1.5	31.8±3.3	160.1±14.9	457.3±48.8
	40/m^2 (Tag)	12.7±0.4	23.8±1.1	34.2±0.7	21.4±2.1	165.2±18.6	476.5±42.0
All Rohu		7.8±0.8	26.1±1.6	32.9±1.3	8.6±1.1	229.8±56.8	412.1±52.0
Catla		10.3±1.2	28.8±1.9	35.8±1.6	12.0±0.1	344.2±76.3	617.8±93.3
Mrigal		8.5±0.6	30.6±1.0	35.7±1.4	9.3±0.1	290.2±35.6	421.7±64.9

Sub-project title : Rearing of selected fish species in hi-tech system for enhanced biomass production per unit area

Project code : I-80(d)

Funding Agency : Institute-based

Duration : April 2012 – March 2015

Project Personnel : B. C. Mohapatra (PI), B. K. Das, S. K. Sahoo, N. K. Barik, Bikash Sarkar (upto 26 Jun 2013), P. B. Bhakat and D. Majhi

There are many types of systems to grow fish i.e., pond, tank, pen, cage, etc. Different systems have unique characteristics, such as shape, size, water use and production economics. Silo is a circular tall tank embodied with self cleaning mechanism, which may be used for storing live fish with high densities for a short period. It is otherwise called as recirculatory system of fish rearing. At CIFA, Bhubaneswar, there are silos with three different heights, i.e., 0.9 m, 1.8 m and 2.7 m with uniform diameter of 2.15 m. To reduce the ammonia load in silo rearing media and to purify it one biofilter unit is installed with the system. Periodically the water loss in silo due to evaporation is substituted with freshwater derived from bore well and pond. It was assumed that in different depths of water, the growth of fish may vary due to environmental effects. Therefore, the present study was conducted for 150 days rearing tilapia, *Oriocromis niloticus* fingerlings as test species in silos to evaluate their growth in relation to the depths of silo.

O. niloticus fingerlings were stocked at the density of 30 nos/m^3 water (0.3687 kg/m^3) at the initiation of the experiment. The total biomass at the time of stocking was 1.11 kg in S1 (Silo with height 0.9 m), 2.212 kg in S2 (Silo with height 1.8 m) and 3.318 kg in S3 (Silo with height 2.7 m).

- In this experiment similar stocking density and water quality was maintained in all heights of silos and same feed with same percentage of biomass was used.
- After 150 days of rearing, 80, 169 and 220 numbers of fish were harvested from S1, S2 and S3 respectively.
- After 150 days of rearing, the fish stocked in S1 (0.9 m) gained more weight than the other two silos with heights 1.8 m and 2.7 m.
- In consideration to the biomass, S1 had more biomass (3.592 kg/m3) in 150 days, than S2 (2.995 kg/m3) and S3 (2.073 kg/m3).
- Total biomass production was 18.656 kg in S3; 17.968 kg in S2 and 10.776 kg in S1.

From this experiment it may be summarized that, the growth, biomass production per m3 of tilapia declined with increase of height of silo.

Table 3. Length (mm) and weight (g) of *O. niloticus* reared in silos over a period of 150 days

Days	Length (mm)			Weight (g)		
	S1	S2	S3	S1	S2	S3
0	90.40±9.06	90.40±9.06	90.40±9.06	12.29±2.76	12.29±2.76	12.29±2.76
25	118.73±20.21	115.00±17.39	105.13±22.99	33.27±14.95	28.58±12.20	22.94±11.98
50	140.23±19.26	135.25±8.75	110.27±14.23	49.46±17.23	43.67±9.61	29.55±9.37
75	155.33±15.43	140.58±15.35	123.10±16.61	76.24±25.14	62.74±16.62	41.88±12.60
100	160.41±17.61	154.45±14.35	139.39±23.09	100.65±31.88	85.1±22.06	57.61±16.54
125	177.2±11.68	167.8±12.61	153.89±12.39	119.45±27.15	101.1±25.58	74.68±14.77
150	186.35±17.18	172.9±12.09	156.25±14.42	134.7±34.45	111.6±27.95	84.8±23.57

Water parameters in silo

All the water parameters were within the safe limits of fish rearing. The ranges of different water parameters pH, Conductivity, DO, CO2, Alkalinity, Ammonia, Nitrite and Nitrate were found 7.1-7.8, 651-806 μS, 2-5 mg/l, 2-10 mg/l, 132-156 mg/l, 0.01-0.56 mg/l, 0.01-0.08 mg/l, and 0.05-0.34 mg/l respectively.

Table 4. Water parameters in silo during experimentation

	pH	Conductivity (μS)	DO (mg/l)	Co_2 (mg/l)	Alkalinity (mg/l)	Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)
S1	7.32±0.17	699.58±25.20	3.85±0.58	4.63±2.00	144±5.33	0.29±0.12	0.04±0.02	0.16±0.06
S2	7.33±0.08	737.79±43.90	3.77±0.51	5.58±1.7	146.53±5.69	0.33±0.14	0.04±0.02	0.16±0.04
S3	7.25±0.10	767.47±25.64	3.49±0.54	4.95±2.25	142.74±5.97	0.33±0.12	0.06±0.03	0.16±0.04
BF	7.59±0.15	648.79±42.50	4.42±0.43	3.05±1.22	141.47±4.05	0.07±0.07	0.02±0.02	0.16±0.07
WS	7.27±0.24	737.5±110.50	3.27±0.33	10.6±2.07	166.67±11.73	0.19±0.18	0.01±0.01	0.10±0.04

(BF = Biofilter water; WS = Water source (pond water and bore well water))

Sub-project title : Productivity evaluation and stock comparison of Indian river prawn, *Macrobrachium malcolmsonii* (H. Milne Edwards, 1844) from different geographical locations of India

Project code : I-80(e)

Funding Agency : Institute-based

Duration : April 2012 – March 2015

Project Personnel : P.L. Lalrinsanga (PI), Bindu R. Pillai, B. B. Sahu, Lakshman Sahoo and S. Sahu

Collection of adult specimen and morphometric studies

Macrobrachium malcolmsonii adult specimens of 87 and 109 numbers from Mahanadi river, Odisha and Godavari river, Andhra Pradesh, respectively were collected for morphometric studies. Morphometric characters including total length (TL), carapace length (CL), standard length (SL) and body weight (BW) were measured for both sexes separately using digital vernier calliper and recorded for analysis. The morphometric parameters are presented in Table 5, which indicated difference between the stocks. The TL, CL, SL and BW of Andhra Pradesh stock was observed to be higher compared to Odisha stock in pooled sex. In addition sexual dimorphism in the morphometric characters were also observed with male showing higher TL, CL, SL and BW compared to female in both the stock. Further the male and female of Andhra Pradesh showed higher TL, CL, SL and BW compared to Odisha stock.

Table 5. Descriptive summary on morphometric characters of *M. malcolmsonii* from Mahanadi river, Odisha and Godavari river, Andhra Pradesh (Mean ± SE)

Stock	Sex	Total length (mm)	Carapace length (mm)	Standard length (mm)	Body weight (g)
Odisha	Pooled	127.48 ± 2.25	33.02 ± 1.98	82.33 ± 2.00	37.51 ± 2.09
	Male	129.97 ± 2.93	34.87 ± 0.94	85.22 ± 1.81	42.394 ± 3.49
	Female	102.41 ± 2.34	25.76 ± 1.12	63.78 ± 1.98	24.07 ± 1.35
Andhra Pradesh	Pooled	147.81 ± 2.79	38.39 ± 1.70	98.39 ± 2.20	43.56 ± 2.56
	Male	158.16 ± 5.28	45.18 ± 1.74	109.83 ± 2.92	57.68 ± 3.86
	Female	132.88 ± 2.62	34.65 ± 1.12	94.17 ± 1.67	28.84 ± 1.63

Carcass evaluation

The adult prawns of varying size composition collected were peeled by hand and subjected to carcass analysis. Several yield parameters including total length, body weight, sex, head weight, weight, tail meat weight and tail shell weight was measured and recorded. The percentage contributions of meat yield were then worked out for different size class. The carcass evaluation showed difference between the stocks (Fig. 5.) with Odisha stock showing higher meat yield compared to that of Andhra Pradesh stock. The meat yield percentage ranges from 28.71 - 40.32 % in Odisha whereas it ranges from 27.06-39.41 % in Andhra Pradesh stock. In addition, it was observed that the meat yield of prawn is sex and size dependent (Figs. 6&7) in the weight class of 20-30 g and above. The meat yield decreases with an increase in size. The meat yield percentage ranges from 28.71 – 41.24% and 36.15 – 40.30% in male and female respectively in Odisha stock. *M. malcolmsonii* from Andhra Pradesh showed a meat yield percentage ranges from 27.06 – 39.71% and 34.86 – 39.29% in male and female respectively. Further, the head weight and tail weight showed variation between sexes. The head weight of male was found to be higher compared to female in the 20-30 g weight class and above for both the stocks. The tail weight was also found to be higher in female compared to male for both the stocks.

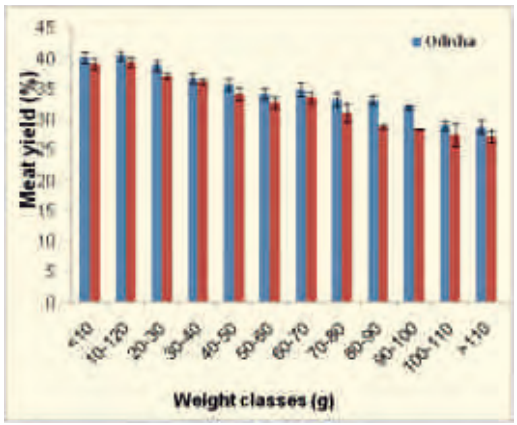


Fig. 5. Meat yield characteristics of *M. malcolmsonii* from Mahanadi river, Odisha and Godavari river, Andhra Pradesh

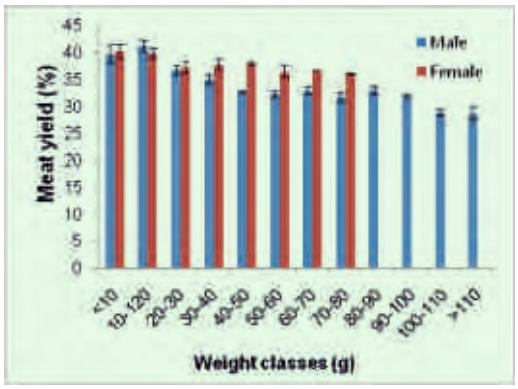


Fig. 6. Sex wise meat yield variation in *M. malcolmsonii* from Mahanadi river, Odisha

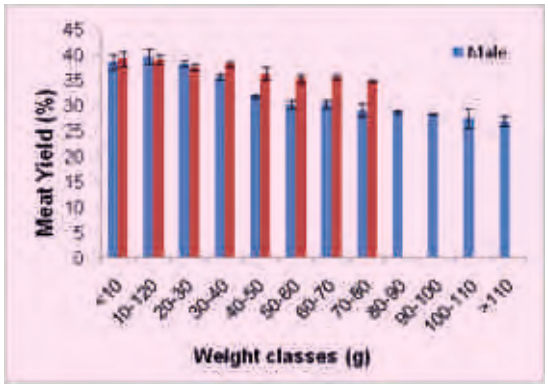


Fig. 7. Sex wise meat yield variation in *M. malcolmsonii* from Godavari river, Andhra Pradesh

Evaluation of reproductive traits in *M. malcolmsonii*

Studies were also under taken to evaluate the reproductive traits of *M. malcolsonii* including the fecundity, the egg size and larval development. Twenty numbers of berried females from both the stocks were collected and the egg clutch were removed manually from the pleopods and weighed. A small sample of eggs was then taken, weighed and all the eggs in the sample were counted using binocular microscope.

The study revealed the fecundity of *M. malcolmsonii* ranges from 5158 to 83854 numbers (with an average per body weight fecundity of 1766.48) and 4607 to 78578 numbers (with an average per body weight fecundity of 1573.23) in Mahanadi and Godavari stocks respectively.

Additionally, the egg size of *M. malcolmsonii* was also evaluated using ocular micrometer under binocular microscope. Although the egg size of Mahanadi stock was slightly larger compared to that of Godavari stock, no significant difference was observed in the egg size between the stocks (Table). The average egg size was 0.54 ± 0.01 mm (length) and 0.46 ± 0.01 mm (width) and 0.51 ± 0.01 mm (length) and 0.43 ± 0.01 mm (width) for Mahanadi and Godavari stock respectively.

Breeding and larval rearing was also conducted successfully in 20 ppt brackish water by adopting conventional clear water technique with water exchange system rather than the previously standardized technique of airlift biofilter system. Grey berried females were collected and kept in 5 ppt water until hatching. Once hatching takes place the spent females were released back into the ponds and the larvae were transferred to 20 ppt brackish water after estimation. The larvae were fed Artemia nauplii initially and supplemented with egg custard from the Vth stage onwards. The larval stages were monitored regularly by observing under microscope. The larval rearing cycle was completed within 45-52 days.

Sub-project title	:	Water management for sustainable and higher aquaculture production
Project code	:	I-80(g)
Funding Agency	:	Institute-based
Duration	:	April 2012 – March 2015
Project Personnel	:	S. Adhikari (PI), P. P. Chakraborty, P. C. Das, R. N. Mandal, B. S. Giri, A. S. Mahapatra, S. Sarkar and B. Mishra

Water Quality Index of pangas culture ponds

The water quality index was prepared for the pangas ponds based on National Sanitation Foundation Water Quality Index (NSF WQI). This WQI was calculated based on the following water quality parameters: biochemical oxygen demand, dissolved oxygen, total fecal coli form, pH, temperature, total nitrate, total phosphate, total dissolved solids and turbidity and accordingly the average value of these parameters were 3 mg/l, 6.0 mg/l, 1 MPN/100ml, 7.8, 25 ^{0}C, 0.53 mg/l, 1.0 mg/l, 100 mg/l and 5 NTU, respectively. Thus the estimated WQI was 71 and accordingly the pangas culture ponds were good water quality.

Water Quality Index as an indicator of aquaculture effluents on water bodies

The water quality index was prepared for aquaculture effluents from pangas culture ponds based on National Sanitation Foundation Water Quality Index (NSF WQI). This WQI was calculated based on the following water quality parameters: biochemical oxygen demand, dissolved oxygen, total fecal coli form, pH, temperature, total nitrate, total phosphate, total dissolved solids and turbidity and accordingly the average value of these parameters were 5.0 mg/l, 5.0 mg/l, 40 MPN/100 ml, 8.1, 30 ^{0}C, 0.60 mg/l, 1.4 mg/l, 150 mg/l and 8 NTU, respectively. Thus the estimated WQI was 57 and accordingly the aquaculture effluents were medium or average water quality. These effluents from the pangas culture ponds could create medium level of pollution to the receiving water bodies.

Water budget for carp culture ponds

Water budgets were calculated for the 12 embankment fish ponds of the institute. Water sources considered include regulated inflow, precipitation and run-off, whereas water losses include evaporation, seepage and effluent discharge for one year. The areas of these ponds were 0.05 ha. The average rainfall was 174 cm while the average run-off was 36 cm in these ponds. The depths of these ponds varied from 107 cm in December to 217 cm in October in these ponds. The overall depth of these ponds was 150 cm. The storage change was 110 cm. The average evaporation was 150 cm while average seepage was 66 cm in these ponds during the year. The loss from the evaporation and seepage could be compensated through the regulated inflow of water either from the canal or from the well. The total amount of water needed in an average year to compensate the water loss through evaporation


and seepage was calculated and for the 1.0 ha pond, 11600 m^3 of water could be applied by the canal or well. At the time of harvest, the drainage was 107 cm which was equivalent to 10700 m^3 of effluent water. Consumptive water use in aquaculture consists of water removed at harvest, and water lost in seepage and evaporation. Considering the production levels of 6 to 8 t/ha/yr, the consumptive water use could be 3.6 to 2.7 m^3/kg fish in these ponds.

Increase in water productivity by management practices

A case study was performed in two different locations at Puri and one location at Jajpur districts of Odisha to evaluate the increase in water productivity by adopting recommended carp culture practices over farmer's traditional practices. In farmer's practice, stocking density was @12,000/ha to 15,000/ha, lime application was @100 to 200 kg/ha/yr, nitrogen and phosphorus application was @ 100 kg/ha/yr and 50 kg /ha/yr, respectively, organic manure @ 5,000 kg/ha/yr and feed @ 1% body weight, respectively. In the recommended practice, stocking density was 10,000/ha, lime application was @ 600 to 800 kg/ha/yr, nitrogen and phosphorus application was @ 200 kg/ha/yr and 100 kg/ha/yr, respectively, organic manure @ 10,000 to 15,000 kg/ha/yr and feed @ 2% body weight, respectively. In farmer's practice, the water quality parameters, viz. pH was 7.3 to 7.5, total alkalinity was 70 to 80 mg $CaCO_3$/l, dissolved phosphate was 0.005 to 0.05 mg/l, and dissolved nitrogen was 0.05 to 0.08 mg/l. While in the recommended practice, the water quality parameters, viz. pH was 7.8 to 7.9, total alkalinity was 90 to 110 mg $CaCO_3$/l, dissolved phosphate was 0.20 to 0.25 mg/l, and dissolved nitrogen was 0.40 to 0.50 mg/l. Total production was 3.5 to 4.0 t/ha/yr in farmer's practice while the same was 6.3 to 6.5 t/ha/yr in the recommended practice. Total water requirement was 180 to 200 cm for the fish production throughout the year in these ponds. Accordingly, the water productivity in these ponds was 1.94 to 2.0 kg/ha/mm in the farmer's practice while the same was 3.25 to 3.61 kg/ha/mm in the recommended practice.

Uses of eco-friendly chemicals for management of phosphorus content in water

An experiment was conducted to study the efficiencies of lime and gypsum for reduction of phosphorus in waters. The results showed that gypsum was more effective than lime in reducing the phosphorus content of waters. The reductions of phosphorus from the water were 43 and 54 per cent at 5 and 10 mg/l of lime, respectively. The reductions of phosphorus from the water were 75 and 80 per cent at 5 and 10 mg/l of gypsum, respectively.

Sub-project title	:	Refinement of freshwater pearl culture technology for sustainable production of pearls in confined conditions
Project code	:	I-80(h)
Funding Agency	:	Institute-based
Duration	:	April 2013 – March 2016
Project Personnel	:	Shailesh Saurabh (PI), Rajesh Kumar, S. Adhikari, J. Mohanty and U. L. Mohanty

Preparation of Designer Nuclear beads

Five different types of designer nuclear beads were prepared both from conventional source viz. mussel shell and nonconventional sources viz. egg shell, acrylic based material, material X and material Y by using standard procedure developed by pearl culture unit of CIFA. The biocompatibility of prepared nuclear beads in mussel was tested both in indoor as well as in outdoor culture system. Deposition of nacre was observed in all the cases. The study showed that all the prepared nuclear beads were biocompatible with mussels and can be potentially utilized for freshwater pearl culture production.

Designing and development of Innovative low cost pearl mussel holder

The pearl culture unit of CIFA has achieved a groundbreaking success in designing a very low cost indigenous freshwater pearl mussel holder. The grooves of mussel holder is carved in such a way that mussel gets minimum stress during implantation of biocompatible nuclei. Furthermore, this holder is almost ten times cheaper than original Japanese mussel holder. The mode of handling of this instrument is very easy. This innovative designed model of mussel holder would be very useful to spread the skillful technology of pearl culture among farmers and entrepreneurs.

Sub-project title	:	Breeding and culture of tilapia for popularization and brood banking
Project code	:	I-80(I)
Funding Agency	:	Institute-based
Duration	:	April 2013 – March 2016
Project Personnel	:	P. Routray (PI), P. K. Meher, B. C. Mohapatra, N. K. Barik, C. K. Mishra and D. K. Verma

Collection of tilapia populations from different geographical locations and rearing

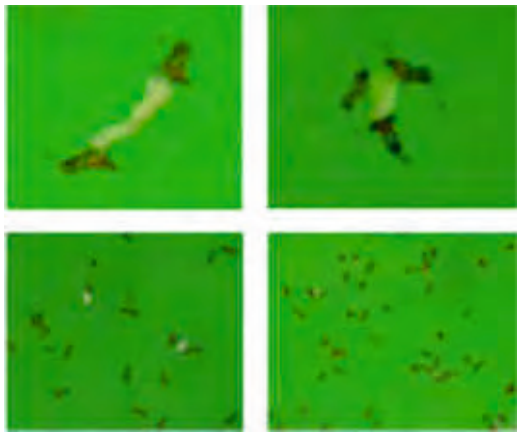
Today, if any fish that could be named as global fish, no better name can be thought of than tilapia. Tilapia the omnivore cichlids are fast becoming a natural choice as a candidate species for aquaculture throughout the world. Tilapia industry is growing at a very fast rate in most parts of the world and it is popularly dubbed as "aquatic chicken" due to its quick growth and propagation. This is not only the second most important farmed fish globally, but also described as the most important aquaculture species of the 21st century (Shelton, 2002).

Tilapia breeding and variety development programme has been initiated at this Institute from the current year. For this, populations of tilapia, *Oreochromis niloticus* were collected from three different geographical locations of India viz. Gujarat, West Bengal and Odisha. Now the collected fry from these locations are being reared in CIFA farm for growth studies and checking the genetic variability.

Production and growth of tilapia reared under monosex and mixed-sex conditions

Mono-sex (male) and mixed-sex tilapia seed with average weight 20-30 g were stocked at a rate of 8000nos/ha in four 0.04 ha ponds using Odisha stock. After six months of culture, average weight attained by tilapia was 400 g and 287 g in mono-sex and mixed culture respectively. A total production of 3.2 ton/ha/ 6 months in mono-sex and 2.29 ton/ha/ 6 months in mixed sex culture was achieved.

Collection of tilapia, *Oreochromis niloticus* populations from three different locations of India to check their genetic variability



Sub-project title	:	Development of alternate gel based food as a substitute for high value live food
Project code	:	I-80(j)
Funding Agency	:	Institute-based
Duration	:	April 2013 – March 2016
Project Personnel	:	B. B. Sahoo (PI), M.R. Raghunath, B.R. Pillai, P.L. Lalrinsanga, K.C. Das, S. Ferosekhan, P.R. Routray, S.K. Sahoo, Rajesh Kumar and U.L Mohanty

Development of alternative gel based food as a substitute for high value live food

The primary objective to substitute high value live food (Artemia, rotifer etc.,) with fish gel based larval food (FGBLF) in larval rearing. Murrel fish gel has been used as a base for making larval food. Fish gel added with gelatin/sodium alginate, mineral mixtures and micro nutrients supplements was made in to a micro bound diet FGBLF. FGBLF applied in *Macrobrachium rosenbergii* hatchery by using a larval food dispenser, the economic advantages are gained by using the larval food dispenser is labour saving device helps in hygienic handling of larval food in *Macrobrachium rosenbergii* hatchery. The particle size of 300-1000 μ was found to be very much acceptable for *M. rosenbergii* larvae. The FGBLF has been found to be stable in water column and have good buoyancy.

Project title	:	Aquaculture development through participatory approach
Sub-project title	:	Development of ornamental fish villages, Landijhari and Sarauli in Deogarh district of Odisha
Project code	:	I-84(b)
Funding Agency	:	Institute-based
Duration	:	April 2012 – March 2015
Project Personnel	:	S. K. Swain (PI), Rajesh N., B. K. Das and P. K. Meher

Selection of beneficiaries and infrastructure

Twenty one farmers of Nuagaon were adopted as beneficiaries after PRA meeting and interested farmers were provided with technical guidance for tank construction for ornamental fish culture. Each beneficiary has constructed 4-6 tanks of 3-400 l capacity (12-16 cubic ft.) in the backyard.

Demonstration of breeding of egg layers

In each unit 130 numbers of live-bearers (one species/ variety) were stocked with a male and female ratio of 1:3 during July 2012 followed by a demonstration programme in presence of AFO, Barkote block. Breeding activity started after 2-3 months of rearing (July-October 13) and (February-March 2014).

Input provisioning

50 selected farmers of Landijhari(21), Nuagaon(18), Saruali(7), Balita(2), Jhumpura(1) and Kalla (1) were provided with water pump (one for 3 farmers), oxygen cylinder (one for three farmers), FRP tanks (4 for each farmers) and accessories like plankton net, hand net as per the requirement under NAIP. Hub was made equipped with Oxygen cylinder, water pump, 10 FRP tanks and accessories like hand nets and plankton nets for enhancing the efficiency of hub in storage and proper package of ornamental fishes for trading.

Production

> 80000 live bearers are produced from 56 farmers and sold @ Rs 3-5 generating income of Rs 7-8000 annually.

Innovations

Adoption of technology was from single to many. Mostly women farmers showed interest and motivated. The success of Landijhari influenced the farmers of Saruali and subsequently farmers of Nuagaon have adopted the technology. Many farmers in the adjacent villages are adopting the technology day by day. Programme was implemented in cluster approach for experience sharing and mutual help which further resulted in specialization and the mass scale production which has attracted the traders for onsite trading and reduction of hazards of transportation. By implanting Hydrilla (submerged weed) plant in the fish tank enhanced the water quality and natural infusorians production as live food leading to larval survival.

Development of marketing linkage

A marketing hub has been established at Barkote (Cement tanks & a pet shop) at Barkote for easy trading of ornamental fishes run by Tulasi Marei, a tribal lady. Breeding of egg layers like Gold fish and koi carp has been demonstrated at the hub.The hub is strengthened with oxygen cylinder, water pump and FRP tanks for the easy operation and proper packaging of live fishes for transportation.

Synergy

ATMA Deogarah has been linked to the programme for partial funding. Linkage to the traders has resulted in economies in production and increase in profit level of the farmers. State Fishery Department has provided Rs 5000/- as incentive to the successful farmers.

Barkote Block is 33 km distance from the District Headquarter, Deogarh & 183 km distance from CIFA. In Barkote Block there are 22 GP, SC / ST, the socio economic backyard community constitute 33% of the total population of 3 lakh. Landijhari,Saruali and Nuagaon the selected villages come under the block. The farmers depend mostly on rain fed agriculture (75%). Majority are OBC followed by SC & ST.

Base line survey was done in three villages to assess their socio economic status. Out of 77 farmers adopted – 60 % are women 30% of the total women farmers are unemployed especially the girls and rest are housewives involved for income generation by utilizing their leisure time. They are mostly from backward community and depend upon daily wage.

Project title : Demonstration and dissemination of freshwater aquaculture technologies for tribal farmers of India

Project code : I-87

Funding Agency : Institute-based

Duration : April 2013 – March 2016

Project Personnel : B. C. Mohapatra (PI), P.P. Chakraborty, S. K. Swain, B. K. Das, N. Sridhar, M.R. Raghunath, Hemaprasant, B. Gangadhar, R.N. Mondal, K. N. Mohanta, P.V. Rangacharyulu, S.K. Sahoo, B.B. Sahu, C. K. Mishra, K. Murmu, A. K. Sahu (upto Sept. 2013), Rajesh Kumar, N.K. Barik, S. Sarkar, P.K. Meher, S. Ferosekhan, P. Jaysankar, U. L. Mohanty, N.Panda and Sukanti Behera

Tribal farmers of Chitrada, Khunta and Badsahi Blocks of Mayurbhanj District and Jamusahi village of Dasapalla Block, Nayagarh District, Odisha were adopted for freshwater aquaculture demonstration programmes. One FRP carp hatchery was installed and demonstrated in Banta Block, Bhadrak District. One FRP carp hatchery was installed and demonstrated at RRC of CIFA, Anand, Gujarat and one unit was supplied for installation in Wainad District of Kerala. One unit was supplied to Gop, Puri for installation. Visits were undertaken to Dahod District of Gujarat for selection and adoption of farmers under TSP-CIFA. 31 farmers under three SHGs were selected for adoption.

The fish biodiversity and livelihood of the Bali Island, Sunderban, West Bengal inhabitants were destroyed in "Aila", the cyclonic storm in 2009. Under TSP-CIFA, 51 tribal farm families were adopted for fish culture and total pond area covered was 5.0 hectares. Initial production recorded was 0.8 t/ha/yr. After adoption of CIFA technology the production ranged between 4.5-6.0 t/ha/yr. Net production achieved was 3.8 t/ha/yr. On 11 March, 2014, Fish Harvest Mela was organized and witnessed by the Scientists from CIFA HQ & Kalyani Centre; CIFE & CARI including the Director, CIFA. FRP carp hatchery was installed and operated in Bali and the spawn production was 4.0 lakh in one operation. Integrated aquaculture with duck was initiated in the Island. Improvement in the production and productivity in the region will enable the people to depend less on the forest for their livelihood, thereby reducing the risk involved in the frequent exposure to ferocious Bengal tigers in forest and

crocodiles in rivers. These works were highlighted in different media and the work at Bali became a National Example.

At Damdama, Birbhum District, West Bengal, 49 farmers through SHG mode were trained for fish culture in a 0.13 ha water area. The carp polyculture demonstration was initiated at Damdama Village on 28 September, 2012. Initially they were provided with all essential materials like fish seed, fish feed, fertilizer, hundi, hapa, drag net, lime, etc. Training on "Grass root level fish farming" was given during 28-29 September, 2013, in which all the tribal farmers participated. The demonstration programme of composite fish culture terminated on 7 June, 2013 and total fish production was about 460 kg. The soil of the area is red & lateritic, which cannot retain water throughout the year, thus a six months experiment was conducted, which fetched a good result i.e. from the benchmark of less than 1 t/ha/yr to about 4.6 t/ha/yr.

Project Title	:	Genetic improvement of freshwater prawn, *Macrobrachium rosenbergii* (de Man) in India - Phase II
Project Code	:	E-40
Funding Agency	:	World Fish Centre, Malaysia
Duration	:	October, 2010 – December, 2013
Project Personnel	:	Bindu R. Pillai (PI), K. D. Mahapatra, P. L. Lalrinsanga, P. K. Meher and S. Sahu

Grow out evaluation of 4th generation of selectively bred *Macrobrachium rosenbergii*

Grow out of 4th generation of selectively bred *Macrobrachium rosenbergii* was carried out in large hapas as well as earthen ponds. The nursed juveniles from 45 families were divided into two groups; one group (140 individuals) was stocked in two large nylon net hapas (5x2x1m) fixed in 100 m^2 concrete tanks or ponds. The other group (60 individuals) was individually tagged and stocked in two 0.04 ha earthen ponds for communal grow-out as back up population. All prawns were individually measured for total length, carapace length, standard length and wet weight before tagging. All prawns were fed @10% of the biomass initially which was modified based on prawn sampling. All hapas were sampled once every three weeks to observe the growth and health of the stocked prawns. During sampling all surviving prawns were collected, counted and restocked into the hapas. Samples of 30 prawns were measured (length and wet weight) to determine the growth and revise the feed rate. Hapas get clogged easily, hence were replaced with cleaned hapa during sampling. Final data collection was done from each of the 90 hapas at 260 days post hatch. During final data collection all surviving individuals were measured for all parameters mentioned earlier. Sex and morphotype ware also noted. Ten heaviest males and 20 heaviest females were selected from each of the 45 families and tagged with VIA tag. After tagging prawns were returned to hapas.

Final survival ranged from 51.3 to 78.5% in different families. Mean final body weight was 19.63 ± 9.6. In 2013 during summer months due to very high water temperature (> 36°C) mortality of stocked prawns was observed in many of the hapas. All the selected individuals from two families were lost due to mortality. Mortality problem was more acute in concrete tanks compared to earthen ponds as the water temperature was higher in tanks. Genetic parameters estimated from data is in Table 6.

Table 6. Variance components, heritability and maternal common environment effect for harvest weight of *Macrobrachium rosenbergii*

Parameter	REML Estimate
Additive genetic variance	17.24
Maternal and common environmental variance	8.37
Phenotypic variance	97.44
Heritability (standard error)	0.18 (0.0485)
Maternal common environment (standard error)	0.09 (0.0180)

Production of 5th Generation (G5) of selectively bred *Macrobrachium rosenbergii*

Breeding for the production of G5 was started in June 2013 based on the mate list prepared to reduce inbreeding. Largest available mature female and male were selected for breeding from each of the selected G4 families and kept for mating. The selected prawns were observed on a daily basis to record spawning. Larval rearing of 56 families was successfully completed. Post larvae from all the families were nursed to a size large enough to be individually identified. Within family selection and pair mating was continued in G5 also. For grow out, the nursed juveniles from each of the 56 families were divided into two groups; one group (140 individuals) was stocked in two large nylon net hapas (5x2x1m) fixed in 100 m^2 concrete tanks or ponds. The other group (40 individuals) was individually tagged and stocked in one 0.04 ha earthen ponds for communal grow-out as back up population. All prawns are being fed @10% of the biomass initially which was modified based on prawn sampling. All hapas are sampled once every three weeks to observe the growth and health of the stocked prawns. During sampling all surviving prawns are collected, counted and restocked into the hapas. Samples of 30 prawns are measured (length and wet weight) to determine the growth and revise the feed rate. Grow out is continuing.

On-Farm testing of 4th generation of selectively bred *Macrobrachium rosenbergii*

On-farm testing of G4 was carried out in four farms in Odisha. Three of the selected farmers provided two ponds each for on-farm testing whereas the fourth farmer provided one pond. Three farmers followed monoculture practice and stocked at 3/m^2 whereas the 4th farmer followed poly-culture practice and stocked at 1/m^2. Farmers who followed monoculture were provided with juvenile prawns and also commercial feed. The growth rate of prawns was monitored at monthly intervals. Final data were collected after a grow out of 154 to 160 days for monoculture and 240 days for polyculture. Twenty percent of the stocked prawns from both selection line and control lines were measured for different body traits to assess their growth performance. The results of on-farm testing of G4 are presented in Table 7. Survival rates of prawns in monoculture operations ranged from 55.6 to 80.1% whereas it was 21% for polyculture.

Table 7. Details of on-farm testing of G4

	DELANG		GOP		SAKHIGOPAL		TINKIPADA
Pond No.	P1	P2	P1	P2	P1	P2	P1
Area (m2)	840	375	556	408	440	290	2600
Initial BW (g)	1.9	1.9	2.4	2.4	2.4	2.4	0.085
Nos. stocked	2400	1000	1500	1100	1200	800	2600
Survival (%)	80.1	63.6	57.4	69.5	55.6	75.2	21
Final BW (g)	49.5	46.2	28.7	38.3	43.0	20.4	60.0

Genotype by environmental interaction study

A study on genotype by environmental interaction (GxE) was initiated to evaluate the growth performance of the generation 5 (G5) of selectively bred *M. rosenbergii* under different agro-climatic conditions of India. Three states in India namely Andhra Pradesh (AP), Assam and Tripura were selected for the study. In AP two places were selected for the study whereas in Assam and Tripura it was conducted in only one farm each. Post larvae of G5 were supplied for GxE study. The seed were packed under oxygen pressure and transported to AP by train (> 20 h travel time). Early juveniles were supplied to Assam by air. The duration of transportation was ~8 hrs. The post larvae were first transported to Kolkata by train (~10 h) and from Kolkata it was sent to Tripura by air. GxE study is under progress.

Project Title : A value chain in murrel production in Tamil Nadu and Odisha (Component 2)

Project Code : E-52

Funding Agency : NAIP-ICAR, New Delhi

Duration : July, 2008 – June, 2014

Project Personnel : Rajesh Kumar (CCPI), A. K. Sahu (upto Sept 2013), Kuldeep Kumar (upto Mar 2013) and U. L. Mohanty

Grow out culture of murrel

The murrel grow out farming was demonstrated in Khurda and Nayagarh District, Odisha. They were provided with inputs like murrel fingerlings and technical support etc. The total area under its culture was 8 acre and average production of about 2.0 t/ha/yr. was achieved. After establishing the market linkages with traders from Kolkata and Andhra Pradesh they received better price for their produce.

Motivation and skill development of farmers for adoption of murrel farming

Training was conducted on "Breeding, seed production and culture of Murrel" for the local farmers during 5-7 September, 2013. The main aim of this programme was to train and motivate the farmers of Odisha for murrel farming. Members from male and female SHGs, ATMA and some

private farmers from Puri, Khurda and Nayagarh districts joined the training programme. It was like hands on training where the trainees were allowed to carry on the steps like injecting the fish, their breeding, egg collection, fertilization percentage, hatching percentage, feed preparation, plankton collection, segregation of murrel seed etc. They were demonstrated developing the brood stock in concrete tanks as brood collection from earthen pond is a tedious job. BMP for murrel farming was also addressed to them. The successful murrel farmers were invited to share their experience in adopting its farming. The training was mainly in participatory mode to enrich their basic ideas on fish farming, especially on murrel. The Director, CIFA had distributed the murrel fingerlings to four progressive farmers of Nayagarh District.

Effect of stocking density on growth and survival of *C. striatus* fingerlings

An experiment was conducted in concrete cisterns to know the effect of different stocking densities on growth and survival of *C. striatus* fingerlings. The different treatments were T_1 (10 fingerlings/m^2), T_2 (20 fingerlings/m^2) and T_3 (30 fingerlings/m^2). Fishes were fed twice with fish meal: rice bran (3:1) at 6-8% of their body mass. The survival and weight gain % were significantly high ($P < 0.05$) in T1 in comparison to T_2 and T_3.

Project Title	:	Sustainable livelihood improvement through integrated freshwater aquaculture, horticulture and livestock development in Mayurbhanj, Keonjhar and Sambalpur districts of Orissa (Component-3) (CIFA-IIHR-CARI-XIMB Collaborative Project)
Project Code	:	E-54
Funding Agency	:	NAIP-ICAR, New Delhi
Duration	:	April 2009 – March 2014
Project Personnel from CIFA	:	P. Jayasankar (CL), S. K. Swain (CPI), P. C. Das, B. C. Mohapatra, S.K. Sahoo, H. K. De, S. C. Rath, P. K. Meher, N. K. Barik, , Rajesh Kumar, Rajesh N. and B. Mishra

National Agricultural Innovation Project (NAIP) of Indian Council of Agricultural Research (ICAR), New Delhi was implemented in the disadvantages districts like Keonjhar, Mayurbhanj and Sambalpur of Odisha under consortium mode. 4077 farm families including 1000 additional farmers (extension phase 2012-14) in 36 villages in 8 clusters were adopted for aquaculture, horticulture and livestock interventions for improvement of their livelihood.

Five farmer friendly aquaculture technologies were introduced for the employment generation as well as enhancement in income through improvement in aquaculture, horticulture and livestock of the adopted beneficiaries in the rural and tribal regions.

Induced carp breeding: 365 lakhs spawn were produced with an average income of Rs 10000 per cycle/HH and 90 human days were generated for the 79 adopting farm families through installation of twelve FRP hatcheries.

Carp seed rearing (fry/fingerling): The technology was demonstrated in seasonal/small ponds of 4.605 ha water area of 84 farmers with an average income of Rs 3150 generated per HH/Yr.

Scientific carp poly culture: The technology adopted by 1656 farmers in 150 ha water area could generate an employment of 100 man days with an average productivity 2.38 t / ha /yr and an average income of Rs 22250/HH/year.

Ornamental fish breeding and culture: Over 20 lakhs of ornamental fish (livebearers) was produced through installation of 30 FRP production units implemented in public private partnership mode. 264 farmers in 24 Self Help Groups (SHG) including 18 women SHGs and 6 individual units are involved in breeding, rearing and selling of ornamental fishes. The technology could generate an average income of Rs. 70650/ per unit/2cycles (8 months) under SHG mode.

As a horizontal expansion under NAIP, the ornamental fish breeding and culture technology was replicated by 77 farmers (including 70% women) of Landijhari, Saruali and Nuagaon villages of Barkote block of Deogarh district of Odisha.The adopting farmers (especially women

and unemployed youths) could be able to earn Rs7000-8000 per farmer/8 months (2 cycles). A marketing hub has been established and strengthened at Barkote, Deogarh for easy sale of ornamental fishes produced by the farmers of ornamental fish villages. Successful farmers are supported with inputs under the project.

Integrated fish cum duck farming: 137 farm families were adopting the technology in 20.2 ha water area with an average income Rs. 30000/ HH/Yr from fish & Rs 11000/HH/Yr from duck (meat and eggs) and employment of 125 days.

Capacity Building and Synergy

4395 farmers were benefitted through exposure visits, capacity building programmes, workshops and farmers meet conducted for successful adoption and implementation of the technology and sustainability. Handouts, reading materials, brochures etc., in vernacular languages were provided for ready reference of the farmers.

Linkages with the line departments, Krishi Vigyan Kendras, NGOs, FFDA, traders, feed producers, seed vendors, ATMA, city markets, local mandis, progressive farmers and other stake holders had benefitted the farmers during and after the project period for successful implementation and sustainability respectively.

Project Title	:	Development of captive broodstock bank of giant freshwater prawn, *Macrobrachium rosenbergii* (Scampi) at Nellore, Andhra Pradesh *(Collaborative project between College of Fisheries, Nellore and CIFA)*
Project Code	:	E-67
Funding Agency	:	NFDB, Hyderabad
Duration	:	December, 2010-March, 2014
Project Personnel	:	Bindu R. Pillai (PI), P. V. Rangacharyulu and Ramesh Rathod (on study leave)

A total of 28,000 good quality scampi seed were supplied to College of Fisheries, (CFSc) Nellore for raising to broodstock in the Nellore broodstock bank. The growth and survival of the stock was monitored at monthly intervals. Good quality, healthy and active broodstock were raised from the seed supplied by CIFA. A review meeting was conducted at CIFA on 30th July to review the progress of the project and to decide on the future course of action. Due to the rapid spread in the culture of imported white shrimp *Litopenaeus vannamei* almost all commercial scampi hatcheries in Nellore were shifted to white shrimp seed production and this has negatively affected the distribution of the broodstock raised in the broodbank.

DST Women Scientist Schemes

Project Title	:	Screening and characterization of an efficient Δ -6 desaturase among warm freshwater fishes in India
Funding Agency	:	DST Women's Scientist WOS-A Scheme, Govt. of India
Duration	:	March, 2011 – March, 2014
Project Personnel	:	Madhusmita Nayak (PI) and Ashis Saha (Mentor Scientist)

Molecular characterization and expression analysis of Δ -6 fatty acyl desaturase in the freshwater carp, *Puntius gonionotus*

The full-length cDNA of silver barb Δ 6-fad cDNA (GenBank Accession No: JX678221) was obtained by RACE strategy .The amplified silver barb Δ 6-fad cDNA was 2060 bp in size with a 117 bp 5'UTR, 608bp 3'UTR and 1335 bp ORF encoding 444 amino acid (aa) corresponding to 52.23 kD translated protein. The domain prediction by SMART revealed the putative cytochrome b5 domain covering positions 21-95 of the protein sequence and transmembrane domain covering position 146-168, 266-284 and 304-326. The multiple sequence alignment analysis revealed that the deduced amino acid sequence of Δ 6-fad share a high percentage of identity with Δ 6-fad of other fish, including rohu (90%), zebrafish(88%), common carp(87%) and salmon(65%). Phylogenetic analysis by the neighbor-joining method showed that the silver barb Δ 6-fad gene clustered in the fish delta-6 fad group (Fig. 8). Quantitative real time PCR showed that Δ 6fad expressed significantly in liver, intestine, muscle, kidney, brain, skin, fin and eye and very low level detected in gill.

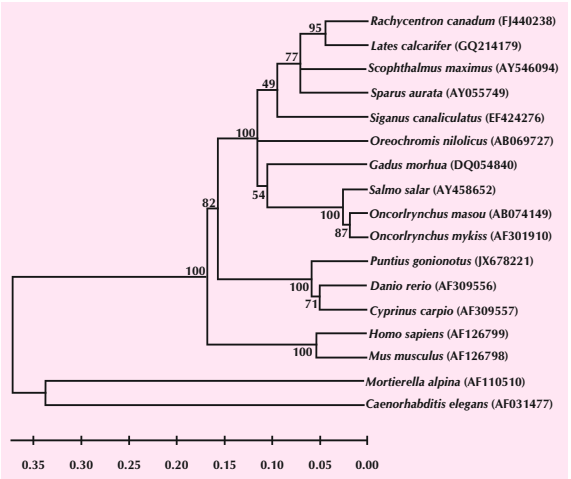


Fig. 8. Phylogenetic analysis by neighbor joining method

B. Fish Genetics and Biotechnology

Project Title	: Genetic upgradation of freshwater fish and shellfish
Project code	: I-59
Funding Agency	: Institute-based
Sub-project	: Development of parentage analysis system and genomics resource in rohu and *Macrobrachium rosenbergii*
Project Code	: I-59 (J)
Funding Agency	: Institute-based
Duration	: April 2011 – March 2014
Project Personnel	: P Das (PI), P. K. Meher, L. Sahoo, J. N. Saha, P. Jayasankar and B. R. Pillai

A subset of eight microsatellite loci out of 17 loci was considered based on high PIC values for inclusion in microsatellite marker suite for parentage assignment. The highest exclusion efficiency was observed with two loci. The resut of the simulation study revealed that combined exclusion probability of eight microsatellite markers was 0.999 (Fig. 9). However using the real data set, 106 individuals out of 108 could exclusively be assigned to their correct parental pairs. The correct matching rate was more than 98% which is comparable to the simulated study (99.9 %).

A total of 630 rohu QTL mapping population (F2) produced and reared separately in the nursery rearing pond were tagged with PIT tags and reared in common environment with length-weight information. Sampling was conducted at three months interval twice for final data analysis.

RNAseq of muscle and liver tissues of control and growth selected rohu resulted in approximately 9 lakhs reads and after assembly there were at least 2700 contigs. There was manifold difference in the expression profiles of genes between selected and control groups indicating putative candidate genes linked to trait performance.

Partial cDNA sequencing of candidate genes linked to growth and reproductive process of rohu has been achieved. GHRHR, IGF1, ActRIIB and ActRIB genes in *Labeo rohita* resulted in 674bp of GHRHR, 152bp of IGF1, 939 bp of ActRIIB and 666 bp of ActRIB sequences.

In total, 198 microsatellite markers were developed in *M. rosenbergii*. Screening of these markers in the mapping panel resulted in 82 informative markers for this species. Segregation analysis of genotyping data of one mapping panel (T-8) for 42 microsatellite loci produced a partial linkage map of *M. rosenbergii* consisting of 12 linkage groups (Fig. 10).

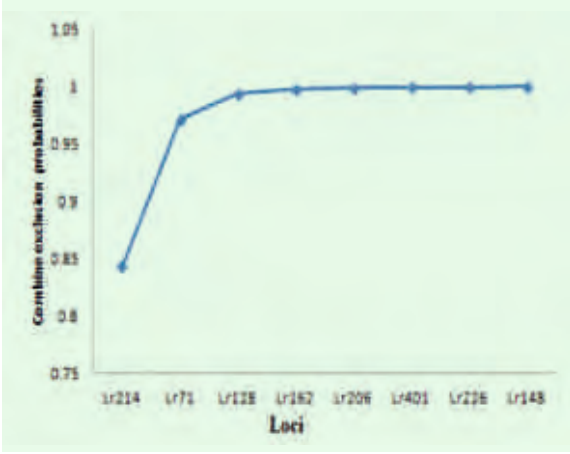


Fig 9. Combined exclusion power of 8 microsatellite loci

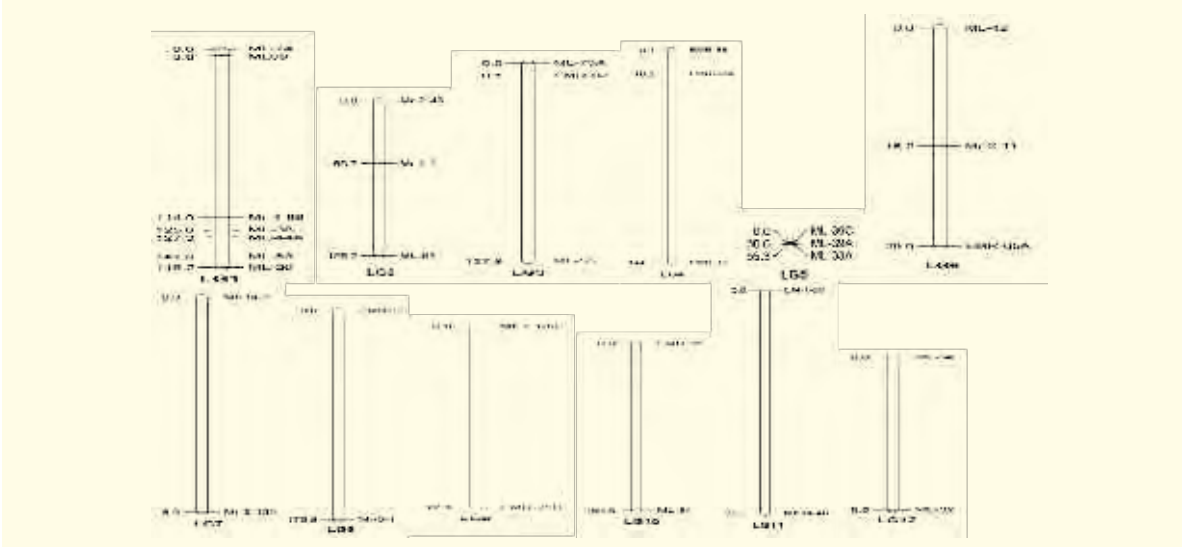


Fig. 10. Partial Linkage map of *M. rosenbergii*

Sub-project : Stock evaluation of catla *(Catla catla)* for establishment of base population and selective breeding of rohu for two traits (growth and disease resistance against aeromoniasis)

Project Code : I-59 (L)

Funding Agency : Institute-based

Duration : April 2011 – March 2015

Project Personnel : K. D. Mahapatra (PI), J. N. Saha, P. C. Das, P. K. Sahoo, K. Murmu, L. Sahoo and B. Mishra

Establishment of catla base population

Ten stocks of Catla was collected from different places of India (West Bengal, Bihar, Odisha, Andhra Pradesh & Uttar Pradesh) and reared separately in nursery ponds. Tagging was completed for catla collected from different sources with PIT tags and being reared in three communal ponds for further evaluation. Growth evaluation for nine stocks of catla was completed and significantly wide range of variation observed between and within stocks (Tables 8&9). Least square mean for each stock was determined after pond correction which was significant.

Table 8. Initial and final body weight of catla from different sources after one year rearing

Variable	Mean	Std Dev	CV	Min (g)	Max(g)
W1 (Tagging weight)	51.23	42.20	82.38	8.00	220.00
W2 (Sampling weight)	1524.32	379.57	24.90	925.00	3000.00
W3 (Final body weight)	2398.27	660.79	27.55	1500.00	4500.00

Table 9. Final body weight of catla from different sources

Source	Mean (g)	std	stderr	CV	Min (g)	Max(g)
C01 (River Ganga lower)	3341.67	624.09	147.10	18.68	2350	4500
C02 (Awalsidhi hatchery, Kolkata)	1960.00	391.44	123.78	19.97	1500	2850
C03 (Subernarekha river stock, Balasore	2175.00	313.91	87.06	14.43	1500	2550
C04 (State Kausalyaganga hatchery)	2325.00	517.20	125.44	22.24	1750	3750
C05 (Kumar swamy hatchery, AP)	2215.63	477.15	168.69	21.54	1700	3100
C06 (Nilu Ghosh hatchery, Kolkata)	2128.57	497.58	188.07	23.38	1725	3100
C07 (Sai Ram hatchery, AP)	2361.11	238.19	79.40	10.09	1900	2600
C08 (CIFA farm)	2168.33	627.24	161.95	28.93	1600	4000
C09 (NBFGR, Ganga upper)	2068.75	393.37	196.68	19.01	1700	2550

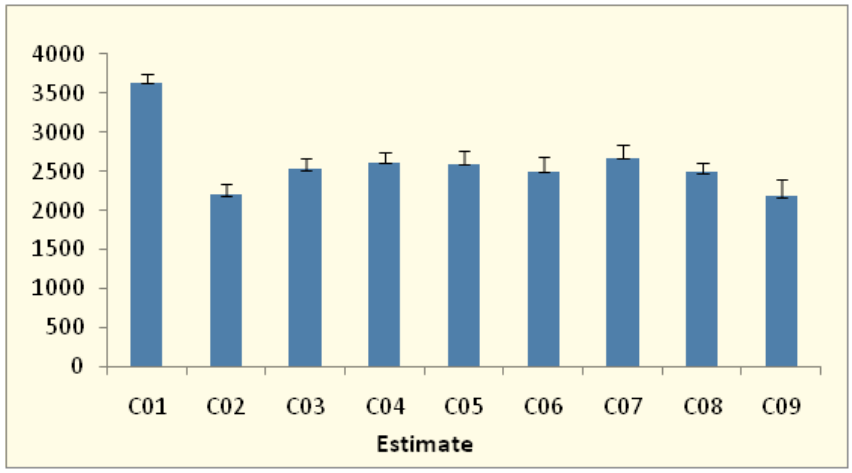


Fig. 11.Least Squares Means of final harvest weight after one year culture of catla from different sources after correction of pond effect

Sub-project : Transcriptomic profiling of the reproduction related tissues during transition from post-spawning regression to initiation of gonad activity in rohu (*Labeo rohita* Ham.)

Project Code : I-59 (n)

Funding Agency : Institute-based

Duration : April 2012 – March 2015

Project Personnel : S. Nandi (PI), P. K. Meher, P. Das, P. Routray, J. K. Sundaray and D. K. Verma

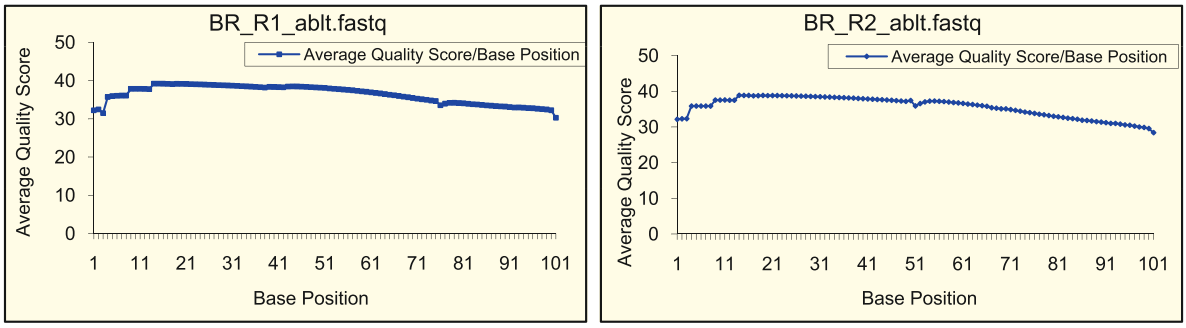
Generation of transcripts profile during pre-paratory and post-spawning phases in rohu

Brain, pituitary, liver, and ovary tissues of adult rohu female were collected during resting (post-spawning in December, 2013) and initiation of gonad maturation (pre-paratory in February, 2014) phases, respectively. The gonado somatic index (GSI) and histological analysis of gonads were carried out to confirm the reproductive phases. RNA of the samples was extracted, quality examined, cleared for library preparation and next generation sequencing (showed RIN > 8.0). Library was prepared following Illumina TruSeq RNA library protocol. The prepared libraries were quantified using Nanodrop and quality validated on High Sensitivity Bioanalyzer Chip (Agilent). The libraries (specific to post-spawning phase) showed peak spread over a range of ~250-700bp with the effective sequencing insert size was expected to be ~130-580bp. Sequencing of the libraries (specific to resting phase) resulted on an average 16 GB (2x 8.0 GB) data containing 100bp(PE) reads for each tissue i.e. Brain, Pituitary, Liver and Ovary. This has generated about 30-37 million reads for different tissue of which minimum 29 million reads were of high quality (93%) after vector and adaptor trimming while base calling at each base position is above 30 (Fig. 12A,B,C,D). De novo assembly of these sequences were carried out using both velvet and oases programmes with hash lengths of 47 (BR), 49 (LIV), 47 (OVA) and 45 (PIT), respectively. These resulted in 56904, 46802, 33707, and 50133 numbers of contigs for Brain, Pituitary, Liver and Ovary tissue in primary analysis with N50 values 1450, 1563, 888 and 1455 in velvet output, for respective tissues (Table 10).

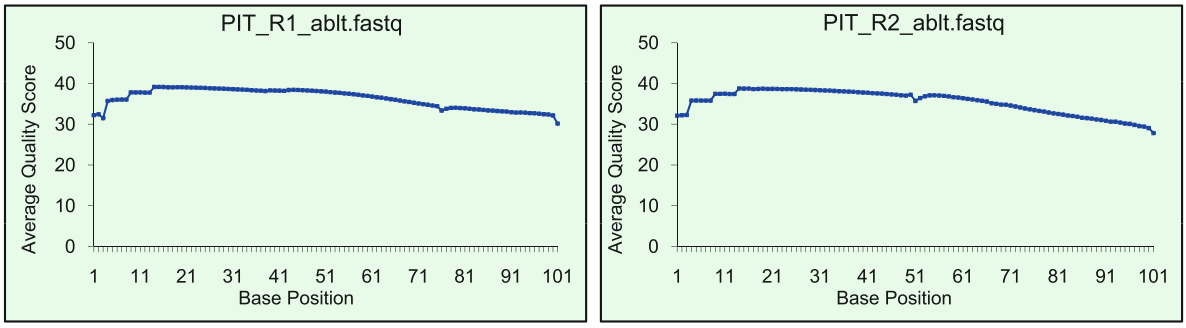
Table 10. Transcriptome De-novo Assembly Statistics

Sample Name	Brain		Liver		Ovary		Pituitary	
Pipeline used for analysis	Velvet	Velvet + Oases	Velvet	Velvet + Oases	Velvet	Velvet + Oases	Velvet	Velvet + Oases
Hash length	47	49	47	45				
Contigs Generated	56904	79400	33707	32888	50133	63136	46802	60060
Maximum Contig Length	15763	16912	11008	11577	14655	15896	16008	16008
Minimum Contig Length	200	200	200	200	200	200	200	200
Average Contig Length	934.2	984.9	663.6	706.6	926.5	870.9	1,002.3 ± 1,013.3	944.1 ± 1,038.0
Median Contig Length	1644.5	569	406	703	4991	355.5	952.5	394
Total Contigs Length	53161700	78200207	22368987	23237296	46447723	54987242	46910366	56702838
Total Number of Non-ATGC Characters	110	66308	0	8917	230	83135	70	53007
Percentage of Non-ATGC Characters	0	0.085	0	0.038	0	0.151	0	0.093
Contigs > = 100 b	56904	79400	33707	32888	50133	63136	46802	60060
Contigs > = 200 b	56904	79400	33707	32888	50133	63136	46802	60060
Contigs > = 500 b	32444	42202	15265	15377	27859	29844	28153	31537
Contigs > = 1 Kb	17233	24984	6043	6624	14773	16325	15512	17650
Contigs > = 3 Kb	2316	4365	269	426	2114	2814	2315	3036
Contigs > = 5 Kb	408	866	26	45	398	578	459	612
Contigs > = 10 Kb	8	29	1	2	13	28	13	16

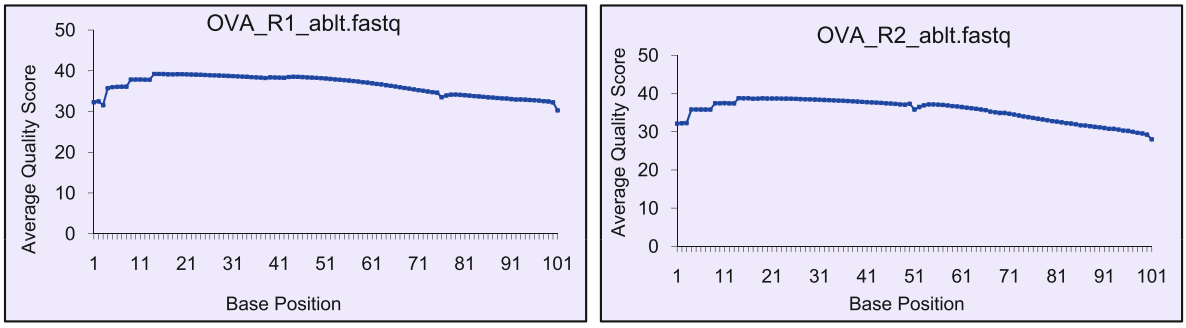
N50 value	1450	1720	888	990	1455	1519	1563	1610
No. of reads used	35592387	57735325	11171252	51664241	39555014	60993346	25975489	48276044
Total no. of reads	67583682	67583682	60200205	60200205	70996936	70996936	56007306	56007306
% of reads assembled	52.66	85.42	18.55	85.82	55.71	85.9	37.46	86.19



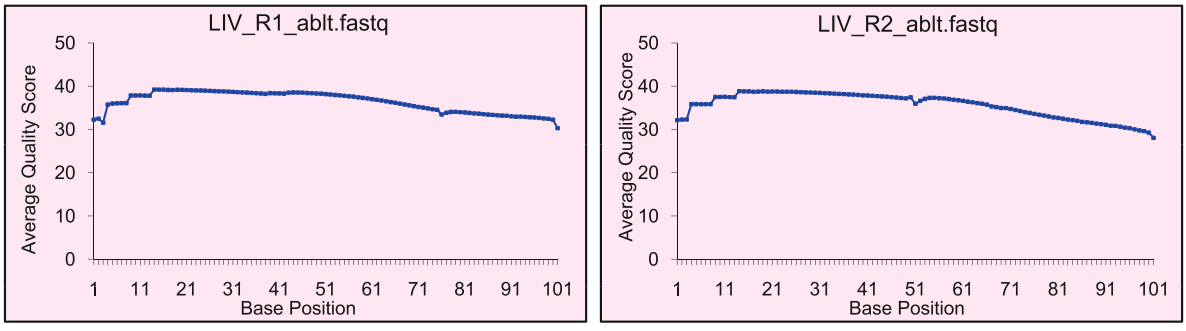
(A) Brain



(B) Pituitary



(C) Ovary



(D) Liver

Fig. 12(A,B,C,D).Showing quality score at different Base Positions (1-100) in Next Generation Sequencing of tissue libraries for rohu female

Sub-project	:	Proteomic analysis of differentially expressed proteins in giant freshwater prawn, *Macrobrachium rosenbergii* in response to biotic stressors
Project Code	:	I-59 (O)
Funding Agency	:	Institute-based
Duration	:	April 2013 – March 2015
Project Personnel	:	J. Mohanty (PI), P. K. Sahoo and B. R. Pillai

Differentially expressed proteins in post larvae of freshwater prawn, *Macrobrachium rosenbergii* in response to *Vibrio harveyi* stimulation were studied by 2D gel electrophoresis. Live post larvae of fresh water prawn, *M. rosenbergii* were collected and acclimatized in laboratory in 2 ppt saline water for 24 h prior to bacterial exposure. The post larvae were exposed to the bacteria, *Vibrio harveyi* at a final concentration of 10^6 cells/ml. After 3 h of exposure, the post larvae were transferred to fresh 2 ppt saline water. Post larvae challenged with only tryptone soya broth (TSB) were taken as control. Post larvae samples collected at different time periods during the experiment were as follows: 1. Control post larvae (after 48 h of TSB exposure), 2. Moribund post larvae (after 48 h of bacterial exposure), 3. Survivor post larvae (after 96 h of bacterial exposure) and 4. Survivor post larvae (after 11 days of bacterial exposure). Protein samples for 2D gel analysis were prepared by triturating the post larvae in mortar and pestle in presence of protease inhibitor followed by acetone-TCA protein precipitation method. Protein concentrations in the sample were measured and adjusted as required for the 2D gel electrophoresis. The 1st dimension IEF was run on 7cm IPG strip, pH at 4-7 for 7000 Vh and the 2nd dimension SDS-PAGE was run on 12% separating gel at 150 V. Finally the gel was stained with silver stain. Detection of proteins in the 2D gels was carried out by scanning the gel in ImageScanner III (Fig. 13). The gel images were compared and analyzed by the ImageMaster 2D Platinum 7.0 software. Differentially expressed proteins were detected by comparing the matched and unmatched protein spots. Further analysis of the gel is in progress to determine the differentially expressed proteins.

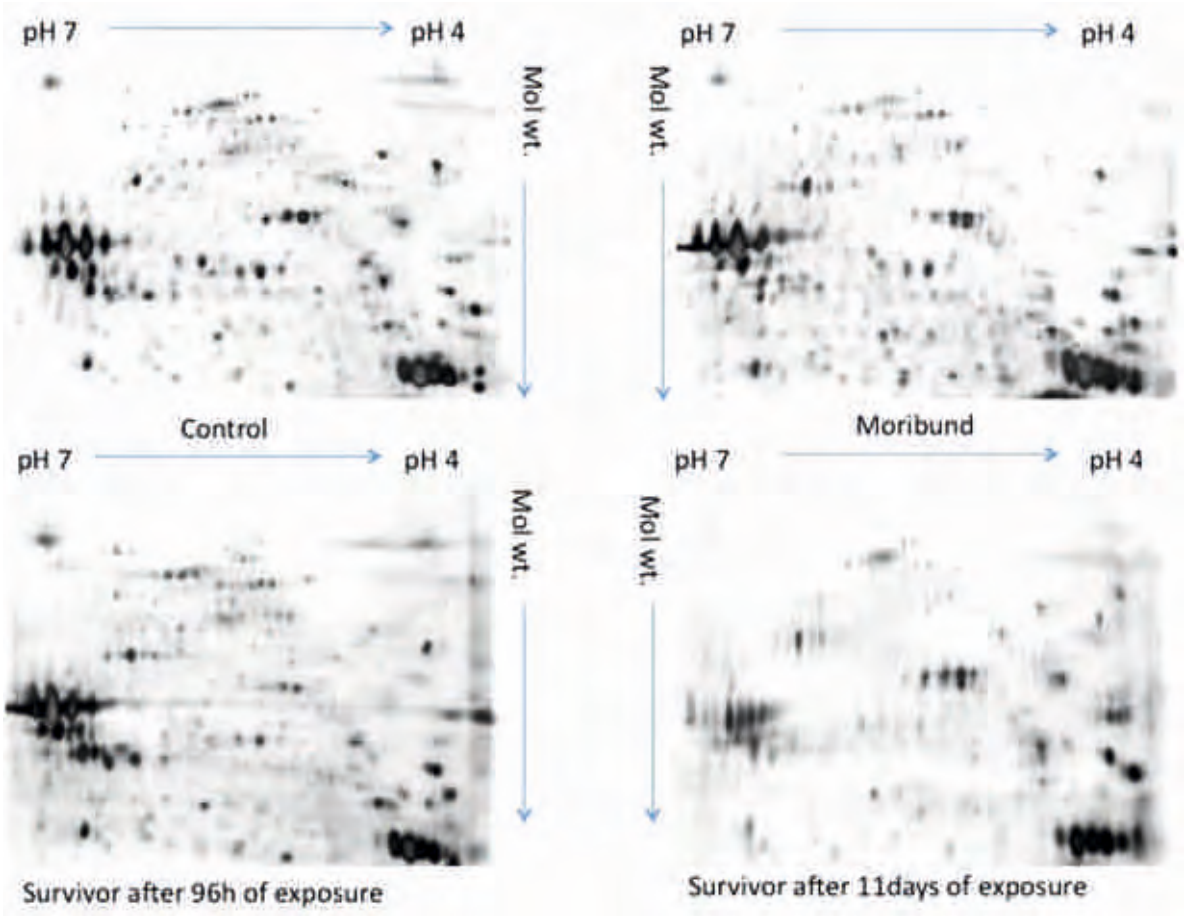


Fig. 13. 2D gel images of 1. Control post larvae, 2. Moribund post larvae, 3. Surviving post larvae after 96h, 4. Surviving post larvae after 11d

Sub-project	: Establishment of base population for genetic improvement of *Labeo bata* (Hamilton, 1822)
Project Code	: I-59 (P)
Funding Agency	: Institute-based
Duration	: April 2013 – March 2016
Project Personnel	: P. K. Meher (PI), P. Das, L. Sahoo, P. Routray and J. K. Sundaray

More than 800 *Labeo bata* (fingerling and adult) were collected from four different locations: Balakati, Jobra, (Odisha), Kalyani and Ramsagar (West Bengal). Initially, genetic variation between two populations (Jobra and Ramsagar) of *Labeo bata* was evaluated using rohu microsatellite markers. The two populations were genetically different as evident from the allelic differences. Homologous loci may be developed and included to screen the populations to quantify the genetic diversity.

Sub-project	: Establishment of base population and stock evaluation of Indian major carp, *Cirrhinus mrigala*
Project Code	: I-59 (Q)
Funding Agency	: Institute-based
Duration	: April 2013 – March 2016
Project Personnel	: Khuntia Murmu (PI), K. D. Mahapatra, J. N. Saha, L. Sahoo and J. K. Sundaray

A total of 200 numbers of *Cirrhinus mrigala* with the size range of 5-10cm fingerlings were collected from four different geographical locations like Ramsagar (West Bangal), Assam Beel, Asam state Govt. hatchery and Brahmaputra river. They were reared separately in nursery ponds for 2-3 months. After taking length and weight they were tagged and released in communal rearing pond for further growth. Highest average body weight gain was observed in Assam hatchery stock whereas lowest average body weight gain was observed in Assam Beel stock. DNA isolation of two stocks is done and rest is in progress.

Sub-project	: Development of genomics resources in Indian major carp, *Catla catla*
Project Code	: I-59 (R)
Funding Agency	: Institute-based
Duration	: April 2013 – March 2016
Project Personnel	: Laxman Sahoo (PI), P. Das, P. K. Meher, K. Murmu and J. K. Sundaray

Next generation sequencing of a portion of catla genome generated approximately 5.7MB of sequence data and 29794 contigs after assembly. Out of 29794 contigs, 21477 contained simple sequence repeats and most frequently encountered repeat motifs were dinucleotides (50%). Three hundred forty four contigs had size $\geqslant$ 90bp. Only 81 sequences had enough flanking sequences on both sides for primer designing. Out of 81 loci, 53 were successfully PCR amplified in a panel of five unrelated individuals. Fifteen randomly chosen loci were characterized in a panel of thirty-two wild catla individuals resulting in 13 polymorphic loci. Number of alleles per locus, observed heterozygosity, expected heterozygosity and polymorphic information content (PIC) ranged from 3 to 6, 0.565 to 0.870, 0.483 to 0.804 and 0.00 to 0.704 respectively.

Project Title	: Improvement of culture conditions, characterization and elucidating underling Oct4 mediated networking pathways for spermatogonial stem cells of *Labeo rohita*
Project Code	: E-73
Funding Agency	: DBT
Duration	: September 2011 – September, 2014
Project Personnel	: H. K. Barman (PI), K. D. Mahapatra and J. N. Saha

Delineating gene structure and discovering minimal promoter of *Pou2* expressed in spermatogonial cells of rohu carp, *Labeo rohita*

Mammalian *Pou5f1* is a known transcriptional regulator involving maintenance of embryonic and spermatogonial stem cells. Little is known about teleost *Pou2*, an ortholog of mammalian *Pou5f1*. Evidences of discrepancy in expression pattern

between fish species were documented. To better understand, we have cloned and characterized *Pou2* gene of farmed rohu, *Labeo rohita*.

It contained five exons with an open reading frame of 1419 bp long, translatable to 472 aa. A bipartite DNA binding domain termed POU domain, comprising of POU-specific and POU-homeo sub-domains, was identified. Rohu *Pou2* is highly conserved with zebrafish counterpart, as evidenced by phylogenetic analyses showing 92% overall sequence identity of deduced protein (Fig. 14). The POU domain remained highly conserved (showing more than 90 % identities) within fish species. Even though there is a divergence between *Pou2* and *Pou5f1*, the common POU-specific domain remained conserved throughout eukaryotes indicating their possible involvements in common trans-activation pathway(s) between mammals and nonmammals.

In support, we have provided evidence that *Pou2* is indeed abundantly expressed in proliferating rohu spermatogonial cells (Fig. 15) and hence participates in stem cell maintenance. Its mRNA accumulation in the ovary supported about its maternal transmission with possible regulatory roles during embryogenesis.

The 50-flanking region (~2.7 kb) of rohu *Pou2* was sequenced and computational analysis detected several putative regulatory elements. These elements have been conserved among fish species analyzed. Luciferase assay identified, for the first time, a 'TATA-less promoter' capable of driving *Pou2* gene transcription (Fig. 16). These findings will help for future studies in elucidating participatory role of fish *Pou2* in male germ cell development.

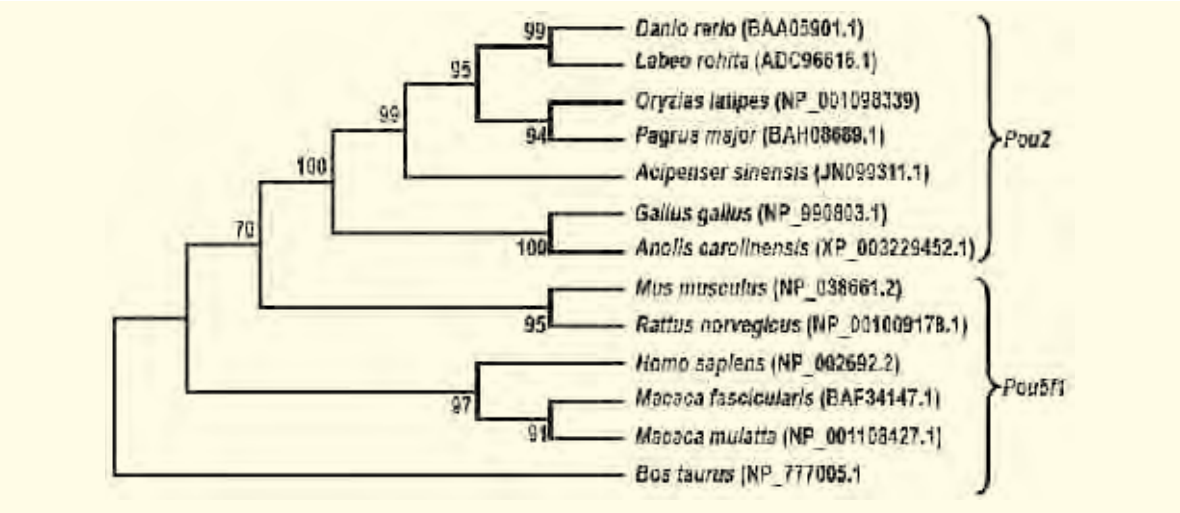


Fig. 14. Phylogenetic relationship of Class V POU family proteins as analyzed with MEGA4.1 program by bootstrap analysis using Neighbour-Joining method (500 replicates). GenBank Accession numbers are mentioned in the parenthesis of respective species.

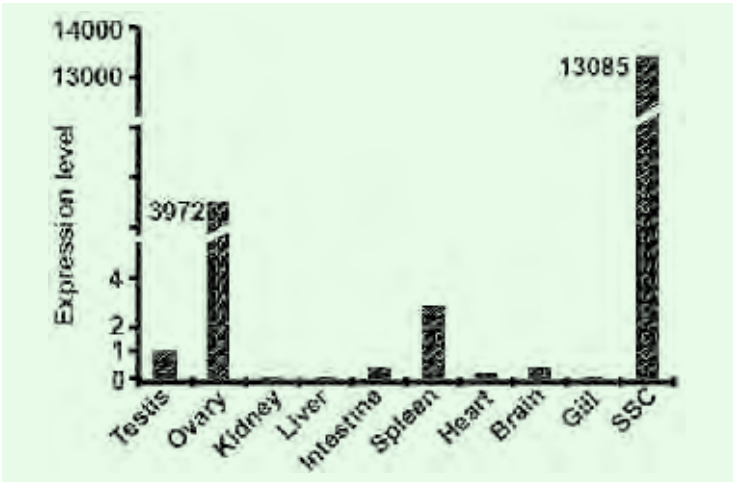


Fig. 15. Relative expression profile of Pou2 gene in different organs including spermatogonial cells of Labeo rohita analyzed by qPCR. The qPCR data for Pou2 in each tissue was normalized with both beta-actin and Elfa as reference genes and the mean values are shown. Relative expression was quantified with a default setting for testis. The data represent the means of three independent experiments, each with triplicate (SE bars are negligible).

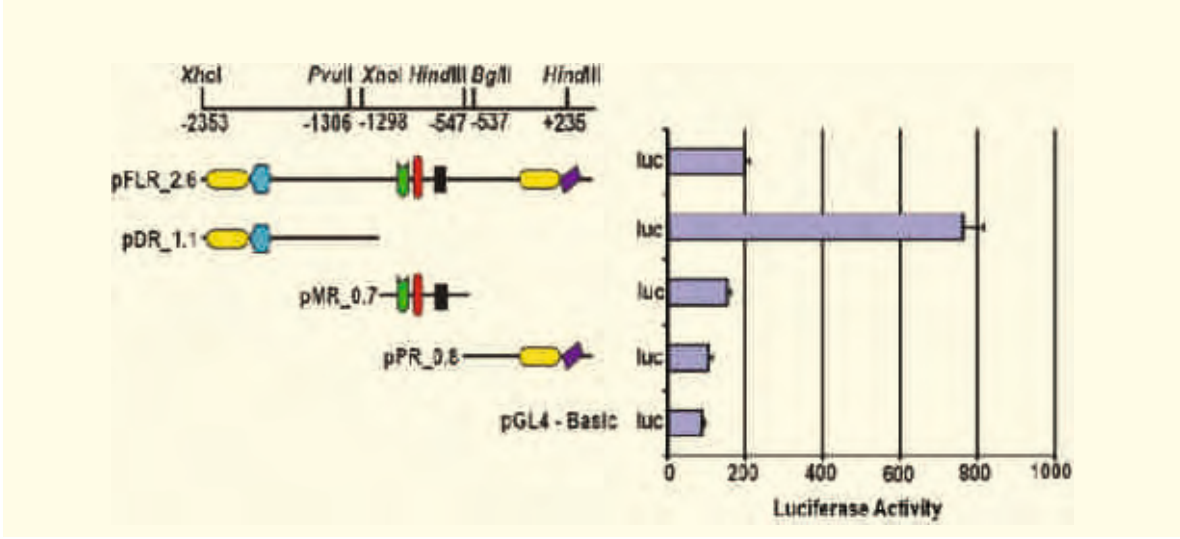


Fig. 16. Analysis of the activity of luciferase reporter constructs carrying different elements of the regulatory region of Pou2 gene in HEK293 cell line. RXR element shown in yellow color, Sp1/GC in light blue, AT-binding factor in red, DeltaEF1 in black, Gfi1 in green ( ) and Sox2 element is represented in violet color. Top-panel shows the restriction enzyme sites used to generate constructs in pGL4-Basic. The pDR_1.1 construct displayed maximum luciferase activity as compared to other constructs. PR proximal region, MR middle region, DR distal region, RXR retinoid X receptor, VDR vitamin D receptor, AT-BF AT-binding factor, Delta EF1 crystalline enhancer binding factor, Gfi1 growth factor independent 1.

Project Title	:	Development of molecular marker-based seed identification system of cultured carps (Cyprinidae)
Project Code	:	E-74
Funding Agency	:	DST, Govt. of India
Duration	:	September 2011 – September, 2014
Project Personnel	:	P. Jayasankar (PI), P. Das, L. Sahoo and B. K. Das

About 300 monomorphic microsatellite markers initially developed in *Labeo rohita* were cross amplified in six different species : *Catla catla, Cirrhinus mrigala, Labeo fimbriatus, Labeo bata, Cirrhinus reba* and *Labeo gonius*. Only 20 markers were found to be monomorphic in all the species (Fig. 17). These markers were used for the identification of species.

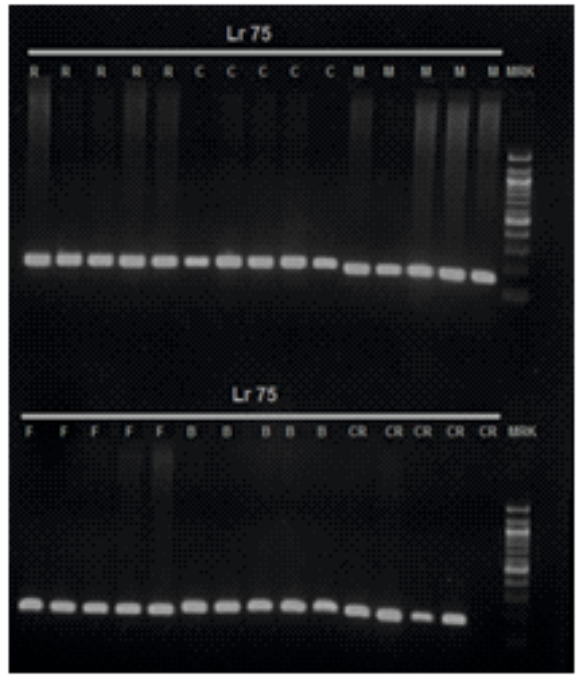


Fig. 17. Cross amplification of monomorphic markers in other species

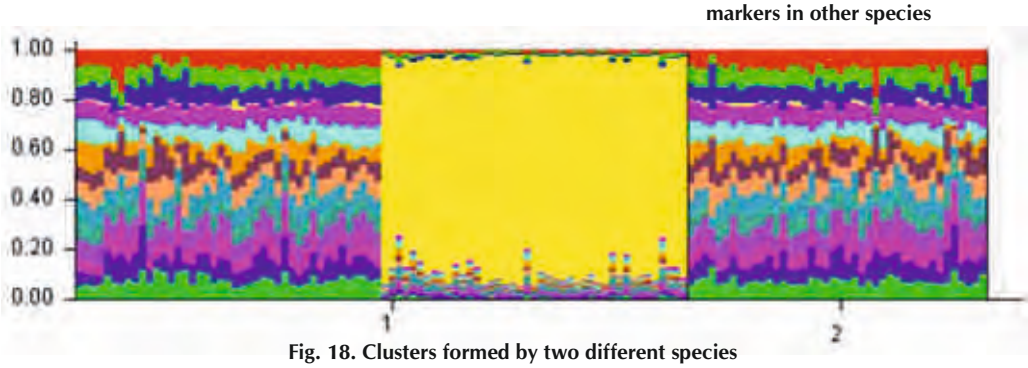


Fig. 18. Clusters formed by two different species

Four polymorphic microsatellite markers were cross amplified in *Catla catla* and *Cirrhinus mrigala* and genotyped to find the allele frequency to differentiate two species. The genotyped data was analysed in STRUCTURE v 2.3.4 to delineate between the species. Population 1 with both mrigala and catla with two different colors whereas population 2 contains only mrigala showing similar pattern with that of population 1 mrigal data (Fig. 18).

Project Title	: Stock improvement and quality seed production of important freshwater carp, catfish and prawn: prerequisite for National Freshwater Fish Brood Bank (NFFBB)
Project Code	: E-80
Funding Agency	: NFDB
Duration	: February, 2013 – February, 2018
Project Personnel:	K. D. Mahapatra (PI), P. K. Sahoo, Bindu R. Pillai, S. K. Sahoo, P. C. Das, J. N. Saha K. Murmu and B. Mishra

Under this NFDB funded project, in collaboration with NFFBB, 46,710 numbers of improved rohu "Jayanti" fingerlings was supplied to 11 states like West Bengal, Karnataka, Chhattisgarh, Tamil Nadu, Maharashtra, Madhya Pradesh, Odisha, Andhra Pradesh, Jharkhand, Assam and Tripura. Three states also received minor carps *i.e. L. fimbriatus, L. gonius* and *P. sarana* seed. On-farm evaluation of G4 freshwater prawn is under progress at NFFBB with very encouraging growth performance. Carp as well as prawn hatchery survey is under progress at Odisha state.

Project Title	: Whole genome sequencing and development of allied genomics resources in two commercially important fish: *Labeo rohita* and *Clarias batrachus*
Project Code	: E-85
Funding Agency	: DBT, Govt. of India
Duration	: September 2013 – September, 2016
Project Personnel	: P. Das (PI), P. Jayasankar, L. Sahoo and P. K. Meher

The whole genome sequencing project has just taken off with the support of Department of Biotechnology, Government of India and ICAR. The collaborative partners are NBFGR, CIFA, Animal Biotechnology Department, Anand Agricultural University and Indian Statistical Agricultural Research Institute, New Delhi. The first draft sequence of two economically important fish species such as *Labeo rohita* and *Clarias batrachus*, and allied genomics resources like large insert library, SNP discovery followed by a map in each as well as a mini bioinformatics workstation have been envisaged in the program. The genome sequencing of the two species is under progress using NGS platform, Illumina. A bioinformatics workstation with CLC-Bio Genomics workbench and Genomics server software has been in place for primary analysis of data. High quality genomic DNA for both the species from different tissues such as testes, liver and muscle has been successfully isolated. At least 2x coverage of rohu genome has been sequenced so far.

OUTREACH PROJECT

Project Title	: Outreach activity on Fish genetic stock
Duration	: 2007-08 – 2012-13
Funding Agency	: ICAR-Network mode
Project Personnel	: P. Das (PI), P. Jayasankar, P. C. Das, P. Routray and S. K. Swain

Population genetics of *Labeo fimbriatus*

Another 60 species specific microsatellite markers have been added to the existing 16 and making a total of 76 markers in this species. A total 192 individual samples of four riverine populations (Mahanadi, Kaveri, Godavari and Krishna) of *L. fimbriatus* were analyzed using 12 polymorphic and labeled microsatellite markers. The number of alleles (NA), observed heterozygosity (HO) and expected heterozygosity (HE) ranged from 12 to 36, 0.705 to 0.753 and 0.657 to 0.914, respectively. Analysis of molecular variance revealed that the genetic variation within populations was 83.1%, and the genetic variation between populations was 16.9% ($P < 0.05$) indicating significant genetic differentiation among above peninsular rivers.

Population genetics of *Cirrhinus mrigala*

Using 17 labeled rohu microsatellite loci and 288 samples, 6 populations (Mahanadi, Godavari, Krishana, Kaveri, Narmada and Mahi) of mrigal was characterized. All the mrigal populations were genetically diverse, with high allelic richness. Number of alleles per locus ranged from 4 to 27, observed heterozygosity from 0.673 to 1.00, expected heterozygosity from 0.586 to 0.959 and inbreeding coefficient (FIS) ranged from -0.067 to 0.010. ANOVA analysis revealed that out of total variation, only 7.71% was among population and 92.29% was within population differences.

C. Fish Nutrition and Physiology

Project Title	:	Applied nutrition in freshwater aquaculture
Project Code	:	I-74
Funding Agency	:	Institute-based
Duration	:	April 2010 – March 2014
Project Personnel	:	S. S. Giri (PI), N. Sridhar, B. N. Paul, S. C. Rath, , K. N. Mohant, P. K. Mukhopadhyay (upto 31.01.2013), M. R. Raghunath, P. V. Rangacharyulu, S. Sarkar and B. K. Pandey

Sub-project	:	Assessment of compensatory growth and its associated chemical and biochemical changes in carps due to restricted feeding and re-feeding
Project Code	:	I-74(d)
Funding Agency	:	Institute-based
Duration	:	April 2011 – March 2014
Project Personnel	:	K. N. Mohanta (PI), S. C. Rath and S. Sarkar

To assess the compensatory growth, nutrient utilization and the chemical and biochemical composition of carp due to different cyclic restricted feeding and refeeding protocols, 8 experimental ponds were prepared as per the pre-stocking pond management practice developed by CIFA, Bhubaneswar and the rohu fingerlings were stocked at 7500 Nos./ha. The fish was fed at 1.5-5.0% of their body weight depending on their size during the experimental period. The intermediary sampling was done in every month and the feeding ration adjusted accordingly. The experiment was conducted for a period of 10 months. The feeding protocol followed are: Control: Continuous feeding of supplementary feed for 10 months as per the standard feeding schedule developed by the Institute; T-1: Feeding of supplementary feed for 2 months + No feeding of supplementary feed for 1 month + Refeeding of supplementary feed for 1 month + No feeding of supplementary feed for 1 month + Refeeding of supplementary feed for 5 months; T-2: Feeding of supplementary feed for 2 months + No feeding of supplementary feed for 2 months + Refeeding of supplementary feed for 1 month + No feeding of supplementary feed for 1 month + Refeeding of supplementary feed for 4 months; T-3: Feeding of supplementary feed for 2 months + No feeding of supplementary feed for 3 months + Refeeding of supplementary feed for 1 month + No feeding of supplementary feed for 1 month + Refeeding of supplementary feed for 3 months. The 100% growth compensation was observed in T-1 and 82% and 76% for the T-2 and T-3, respectively. There was no significant variation ($P > 0.05$) in FCR and PER among all the groups including control. The highest SGR was observed in T-1 and the lowest in T-3. The protein productive values (PPV) and lipid productive value (LPV) were significantly better ($P < 0.05$) in all the restricted feeding and refeeding groups than that of the control group (Table 11). The protease activity of control and T-1 was significantly higher ($P < 0.05$) than T-2 and T-3 groups. However, the maximum protease activity was found in T-1 group. Similarly, the lipase activity was more in control and T-1 than T-2 and T-3 groups (Table 12). Although there was no significant difference in the haemoglobin levels between the treatment groups and control, there was a decrease in haemoglobin level with the increase in feeding restriction. The total glucose level was significantly lower ($P < 0.05$) in Control and T-1 groups than the T-2 and T-3 groups (Table 12). The carcass composition of the fish indicate that although there was significant variation in dry matter, protein, lipid and ash contents of the different groups, the trend was not definite (Table 13).

Table 11. Growth and nutrient utilization of fish reared different restricted feeding and re-feeding schedule

Parameters	Control	T-1	T-2	T-3
Initial weight of fish (g)	5.89±0.22[a]	5.79±0.56[a]	6.10±0.22[a]	5.99±0.42[a]
Final weight of fish (g)	633.47±13.58[a]	662.61±4.69[a]	518.68±14.68[b]	483.24±4.71[b]
Weight gain of fish (g)	627.57±13.80[a]	656.82±4.13[a]	512.28±14.9[b]	477.25±4.29[b]
Survival (%)	92.11±2.11[a]	89.88±1.44[a]	83.55±2.88[a]	88.33±2.33[a]
Growth compensation (%) over the control	-	104.24± 0.37[a]	81.88±2.32[b]	76.28±0.74[b]
Fish production (kg)	251.95±12.05[a]	274.45±7.99[a]	209.90 ±9.30[b]	181.64±4.51[b]
Fish production(kg)/ha	5039.0±24.1[a]	5494.0±164.8[a]	4198.1±186.1[b]	3632.8±90.2[b]
Feed consumed (kg)(Dry matter basis)	416.57±3.82[a]	378.97±16.64[b]	294.28±0.39[c]	228.56±2.01[d]
FCR	1.65±0.09[a]	1.38±0.10[a]	1.40±0.06[a]	1.26±0.04[a]
SGR	1.56±0.02[ab]	1.58±0.02[a]	1.48±0.02[bc]	1.46±0.02[c]
PER	2.39±0.13[a]	2.88±0.21[a]	2.81±0.13[a]	3.13±0.11[a]
PPV	34.82±1.84[b]	45.36±3.27[a]	46.56±2.17[a]	48.68±1.7[a]
LPV	21.97±1.26[b]	28.84±1.07[a]	30.23±1.40[a]	33.92±0.89[a]

Table 12. Digestive enzyme activities and heamatological parameters of fish reared in different restricted feeding and re-feeding schedule

Parameters	Control	T-1	T-2	T-3
Protease activity μg/ml)	82.31±3.73[b]	99.27 ±3.31[a]	58.12±2.92[c]	55.26±3.68[c]
Lipase activity (U/L)	14.62±0.95[a]	12.81 ±0.77[a]	8.07±0.51[b]	8.77±0.31[b]
Haemoglobin level in blood (mg/dl)	102.60±8.12[a]	103.31±6.53[a]	78.05±5.08[a]	75.59±4.12[a]
Total glucose in blood (mg/dl)	60.40±2.28[b]	60.19±5.03[b]	77.53±3.69[a]	86.15±4.4[a]

Table 13. Carcass composition of the fish reared in different restricted feeding and re-feeding schedule

Parameters	Initial	Control	T-1	T-2	T-3
Dry matter (%)	21.44±0.07[d]	21.21±0.05[e]	22.49±0.07[b]	23.59±0.08[a]	21.94±0.06[c]
Crude protein	14.70±0.03[d]	14.47±0.02[e]	15.75±0.04[b]	16.51±0.07[a]	15.53±0.05[c]
Ether extract	2.29±0.02[d]	2.93±0.01[c]	3.23±0.00[b]	3.42±0.00[a]	3.42±0.01[a]
Total ash	1.18±0.01[c]	1.34±0.01[a]	1.15±0.01[c]	1.32±0.01[a]	1.28±0.02[b]

Project Title : Upscaling of photothermal manipulation technique for off-season gonadal maturation in Indian major carp

Project Code : I-78

Funding Agency : Institute-based

Duration : April 2011 – March 2014

Project Personnel : Ashis Saha (PI) and S. C. Rath

Induced breeding of rohu during November and its second breeding during February through photothermal manipulation

Winter breeding of carps was made possible at Central Institute of Freshwater Aquaculture (CIFA) during January and February. During this year rohu (*Labeo rohita*) was induced bred during November-December period and in this particular period normally the rohu fish remain in normal resting phase of the reproductive cycle in natural condition. The monsoon spent rohu were reared in indoor rearing system under controlled phtothermal condition. Within a period of 120 days of indoor rearing these spent brood matured again. During first week of November males were oozing milt. Females were found gravid with prominent secondary sexual characteristics like bulging pelvic abdomen and reddish protruding vent. The fish were induced bred on 23 November 2013 and 20 December 2013 and 22 January 2014. The above spent brood were again maintained in



the controlled environmental condition. The fish which bred during November could get its gonadal maturation with a period of 90 days and induced bred for second time . The fecundity, fertilization and spawn recovery rate was at per with November breeding. This is first ever report of IMC breeding during the month of November-December. Earlier, CIFA bred IMC in all the quarters of the year except October-December quarter. With this achievement CIFA proved that rohu can be bred round the year, which is a boon for seed producers and scope for carp aquaculturist to enhance their earning and livelihood.

Project Title : Feed and Nutrient evaluation in cultivable freshwater fish

Project Code : I-85

Funding Agency : Institute-based

Duration : April 2013 – March 2016

Project Personnel : S. S. Giri (PI), N. Sridhar, S. Adhikari, Gangadhar, B., Saroj Toppo, B. B. Sahu, S. C. Rath, S. Mohanty, K. N. Mohant, K. C. Das, , S. Sarkar and S. K. Nayak

Sub-project : Macronutrients requirement of the Peninsular carps *P. carnaticus*

Project Code : I-85(a)

Funding Agency : Institute-based

Duration : April 2013 – March 2016

Project Personnel : N. Sridhar (PI) and Gangadhar B.

Healthy fingerlings of *P. carnaticus* (n = 180) of an average initial length of 6.40 ± 0.267 cm and body weight of 2.46 ± 0.39 g were reared for 2 months in groups of 12 fish in triplicate indoor aerated plastic tubs of 50 L capacity. Five semi-purified diets were formulated to contain 25-45% crude protein with an increment of 5% CP at each level. Best growth performance was recorded in fish on feeding Feed 3 (Table 14) and FCR was lowest with Feed 3. The carcass composition analyses revealed the lowest moisture and the highest crude protein and fat content in treatment Feed 3 (Table 15). The digestibility of dry matter decreased with increasing dietary crude protein level whereas the protein and fat digestibilities did not show any difference (Table 16).

Table 14. Growth and feed utilization of P. carnaticus fed experimental diets (average + SD).

Growth Parameters	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Initial Weight (mg)	2.38 ± 0.05	2.42 ± 0.05	2.34 ± 0.01	2.45 ± 0.12	2.47 ± 0.11
Final weight (mg)	3.22 ± 0.18	3.23 ± 0.07	3.79 ± 0.21	3.73 ± 0.13	3.57 ± 0.12
Weight gain (%)	35.28 ± 9.86	33.47 ± 4.43	61.95 ± 9.18	52.51 ± 4.82	45.02 ± 7.10
FCR	6.00 ± 1.42	6.00 ± 0.61	3.00 ± 0.24	3.34 ± 0.37	3.73 ± 0.35

Table 15. Carcass proximate composition (% + S.D.) of carnaticus (wet weight basis).

Diets	Moisture	Crude Protein	Fat	Ash
Diet 1	75.97±0.57	16.76±0.40	3.14±0.18	3.62±0.08
Diet 2	76.05±0.32	16.88±0.20	3.24±0.12	3.59±0.05
Diet 3	74.43±0.24	17.55±0.19	4.38±0.30	3.41±0.03
Diet 4	75.94±0.36	16.99±0.14	3.58±0.06	3.32±0.04
Diet 5	75.74±0.42	17.01±0.30	3.39±0.20	3.43±0.08

Table 16. Digestibility (%) of dry matter, protein and fat by P. carnaticus

Diets	Dry matter digestibility	Protein digestibility	Fat digestibility
Diet 1	97.91 ± 1.03	98.78 ± 0.44	99.52 ± 0.25
Diet 2	94.01 ± 0.20	96.29 ± 0.17	97.86 ± 0.16
Diet 3	94.39 ± 0.88	97.27 ± 0.42	96.18 ± 0.50
Diet 4	93.67 ± 0.96	96.79 ± 0.44	97.57 ± 0.62
Diet 5	92.25 ± 0.35	97.63 ± 0.04	98.57 ± 0.01

The study revealed the adequacy of 35% crude protein diet for P. carnaticus fingerlings.

Sub-project : Status and impact of antioxidants in fish feeds
Project Code : I-85(b)
Funding Agency : Institute-based
Duration : April 2013 – March 2016
Project Personnel : Saroj Toppo (PI) and K. C. Das

The non- enzymatic antioxidants Chlorophyll, tannic acid equivalent total phenol and Carotenoid were estimated in feed ingredients of fish feed and plants that grow in pond water and other as sources of antioxidants in natural condition. Three types of extraction solvent used were aqueous, acetone and methanol plus chloroform solution (2:1). Samples were analyzed for chlorophyll, Tannic acid equivalent total phenol and total carotenoid content. Total chlorophyll value (aqueous extract) for most of the green plants were lower compared to other extracts except oil cakes. Highest value of total chlorophyll observed in Azolla followed by colocasia (Colocasia esculenta) and para grass (Branchiaria mutica). Total carotenoid content in vegetative parts of some plants observed from 603 to 8341 μ g/g, which may be used as dietary source of antioxidant.

Sub-project : Improving the protein use efficiency in fish diet
Project Code : I-85(c)
Funding Agency : Institute-based
Duration : April 2013 – March 2016
Project Personnel : K. N. Mohanta (PI) and S. Adhikari

A 7 months pond experiment was conducted in rohu monoculture on feeding optimum (25% CP) and sub-optimum (20% CP) levels of dietary protein following the feeding protocol of: Control group (C): 25% crude protein diet for 7 months, Treatment-1 (T-1): 20% protein for 4 months + 25% protein for 3 months; Treatment-2 (T-2): 20% protein for 3 months + 25% protein for 4 months and Treatment-3 (T-3): 20% protein for 7 month and to observe the growth performance, nutrient utilization and also nutrient gain at the end of the experimental duration of 7 months. Rohu fingerlings of 0.8-1.0 g body weight were stocked at 7500 fingerlings/ha pond. Fish were fed at 5% of their body weight for the first two months and experiment is in progress.

Sub-project : Detoxification and use of plant based non-conventional ingredients in carp feeds
Project Code : I-85(d)
Funding Agency : Institute-based
Duration : April 2013 – March 2016
Project Personnel : S. C. Rath (PI), Saroj Toppo and S. Sarkar

Possibility of incorporation of some non-edible oil cake in fish feed as protein supplement was explored. Oil cake of Indian dumba or Tamanu, (*Calophylum innophylum*) and mohua (*Brasia latifolia*) were identified for experimental use in carp feed. Raw oil cakes were evaluated for its proximate value (Table 17). Both the oil cakes were found rich in protein (22-24% crude protein). Both the oilcakes are available in plenty at cheaper rate.

To evaluate the raw tamanu oil cake (TOC) test feeds (F1 to F5) were formulated incorporating TOC in different inclusion levels, 0, 10, 20, 30 and 40%, respectively (Table 18). Test feeds were iso-proteins (28-29% C.P) (Table 19). *Labeo rohita* fingerlings were reared in indoor condition for a period of 90 days with the test feeds. Performances of fish are presented in Table 20. Monthly growth performance under different test feed is shown in Fig. 19. It was observed that raw TOC incorporation at 10% had no adverse effect on growth and survival of rohu fingerlings. Increasing TOC level above 10% of inclusion significantly depressed the growth and survival.

Table 17. proximate composition of TOC and MOC

Oil cake	Crude protein (%)	Crude lipid (%)	Cruide fibre (%)	Ash (%)	NFE (%)
TOC	24.00	9.00	8.00	6.00	53.00
MOC	22.5	11.1	14.4	4.5	47.3

Table 18. Inclusion of different ingredients in the test feed for *L. rohita*

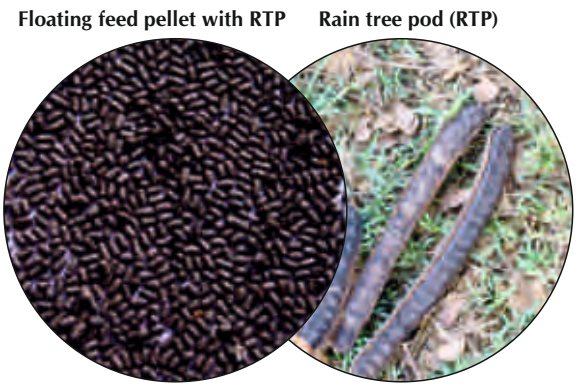
Ingredients	Feed I (%)	Feed II (%)	Feed III (%)	Feed IV (%)	Feed V (%)
TOC	10	20	30	40	0
GNOC	33	30	27	24	37
DORB	53	46	39	32	59
Vit& Min	2	2	2	2	2
Binder	2	2	2	2	2

Table 19. Proximate composition of the test diets at different inclusion level of TOC

Name of the feed	Crude protein (%)	Crude lipid (%)	Ash (%)	Fiber (%)	NFE (%)
Feed I	28.13	2.09	11.7	8.70	49.37
Feed II	28.79	2.12	11.13	8.09	49.87
Feed III	28.73	2.83	10.95	8.50	48.99
Feed IV	28.78	3.56	10.49	8.12	49.05
Feed V	29.12	3.27	11.46	8.43	47.82

Table 20. Growth and survival performance of Catla catla fry with RTP incorporated diets

Feed	Survival %	Weight gain	Weight gain %	SGR
Feed-1	96.97 ± 1.52^{b}	2.04 ± 0.14^{b}	37.12 ± 3.41^{b}	0.53 ± 0.04^{b}
Feed-2	95.45 ± 2.62^{b}	0.78 ± 0.14^{a}	14.32 ± 2.63^{a}	0.22 ± 0.04^{a}
Feed-3	84.85 ± 1.52^{a}	0.56 ± 0.10^{a}	11.07 ± 2.09^{a}	0.17 ± 0.03^{a}
Feed-4	77.27 ± 5.25^{a}	0.57 ± 0.24^{a}	10.88 ± 4.60^{a}	0.17 ± 0.07^{a}
Feed-5	95.45 ± 2.62^{b}	1.91 ± 0.18^{b}	33.40 ± 4.02^{b}	0.48 ± 0.05^{b}



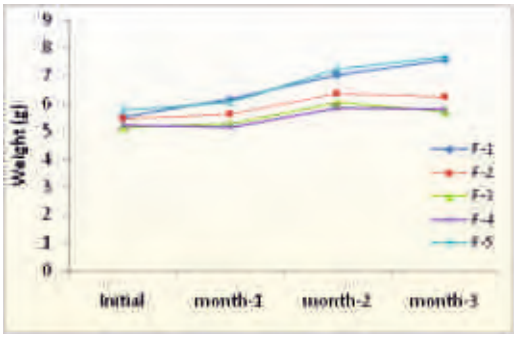


Fig. 19. Monthly body weight changes of *L. rohita* fed TOC incorporated diets in a 90 days experiment

Rain tree pod was incorporated with ground nut oilcake, rice bran and maize in the ratio of 8:8:3 and floating feed was produced in extruder with 20-21% crude protein. The floating efficiency of the pellet was 70%.

Sub-project : Effect of some processing conditions on quality of extruded floating feed for Indian major carps

Project Code : I-85(e)

Funding Agency : Institute-based

Duration : April 2013 – March 2016

Project Personnel : K. C. Das (PI) K. N. Mohanta, B. B. Sahu, S. Mohanty and S. K. Nayak

Diets for grow out Indian major carps (IMC) were formulated with different ingredients available in local market and different types of extruded pelleted feed were prepared in the Feed Mill of the Institute. The feed ingredients of each diet was ground, mixed, preconditioned, extruded and dried for preparation of floating feed. Several types of floating feed were prepared and the best floating pelleted feed was selected. The selected floating feed was further processed by variation of processing conditions like temperature and moisture and floating feeds were prepared. The floating feed prepared on different sets of temperature and moisture were analysed for physical and chemical characteristics to evaluate the quality. The chemical characteristics of pelleted feed on five different extrusion temperatures showed that, the nutrients like Crude Protein (CP), Ether Extract (EE), Crude Fibre (CF), Nitrogen Free Extract (NFE) and Gross Energy (GE) were not affected up to the temperature of 150 ^{0}C. However, lower level temperature (110^{0}C) reduced the floating percentage of the pelleted feed. Moisture level during feed preparation did not have significance on the chemical composition and physical characteristics of the floating feed when moisture level in the feed was maintained from 14 to 24 percentages (including the moisture in the feed) with standard processing conditions. Physical characteristics and chemical composition of the pelleted feed indicated that, best quality floating feed could be prepared from ingredients by maintaining temperature of 130 or 150^{0}C and total moisture level of 20 to 22 percentages.

Project Title : Molecular characterization of gonadotropin and gonadotropin receptors and their regulations during photothermal manipulation of reproduction in rohu (*L. rohita*)

Project Code : E-76

Funding Agency : SERB

Duration : June, 2012 – June, 2015

Project Personnel : Ashis Saha (PI)

Molecular cloning and expression analysis of luteinizing hormone receptor during different stages of ovarian development in rohu *(Labeo rohita)*

Luteinizing hormone (LH) and follicle-stimulating hormone (FSH) are important glycoprotein hormones secreted from the pituitary and these are essential for steroidogenesis, gametogenesis, onset of puberty, and regulation of ovarian cycle. The biological actions of LH are mediated by luteinizing hormone receptor (LHR). To understand the role of LHR during the reproductive cycles of a seasonal breeding fish species, rohu (Labeo rohita), molecular characterization of LHR and its expression pattern were carried out during different stages of ovarian development. Full length cDNA sequences encoding LHR, isolated from ovary of rohu were amplified, cloned, and sequenced. The amplified rLHR cDNA was 2976 bp in size with a 188 bp 5'UTR, 637bp 3'UTR and 2151 bp ORF encoding 716 amino acid corresponding to 78.949 kD translated protein. Analysis of the overall structure indicates that rLHR should be considered as new member GPCR superfamily and in particular to the glycoprotein

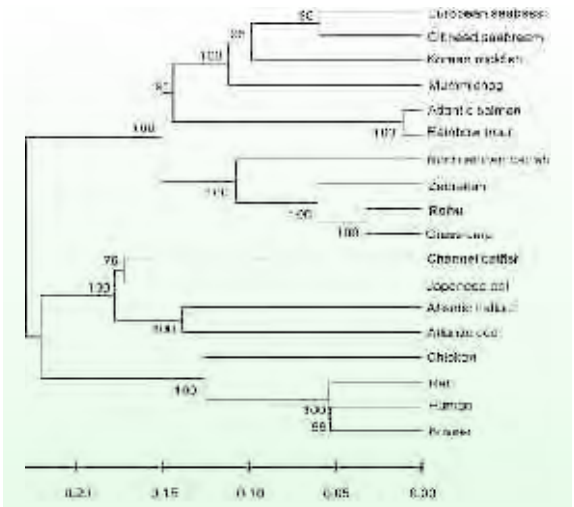


Fig. 20. Phylogenetic comparision of full length LHR amino acid sequences analyzed by MEGA software

hormone receptor (GPR) subfamily. To know the phylogenetic relationship of LHR protein, the deduced amino acid sequence of rohu was analyzed with its full length homologs in other species as shown (Fig. 20). Bootstrap analysis and consensus trees obtained from Neighbor Joining analysis showed that rLHR exhibits highest homology with grass carp followed by zebrafish which cluster in the same branch with a high bootstrap value. Expression pattern of rLHR mRNA were done by quantitative real time PCR and the present result indicate that level of rLHR mRNA increases during ovarian development and shows high level during fully matured stage. The gonadal expression pattern of rLHR gene indicates its significant role in regulating gonadal functions in this seasonal breeder carp species.

Project Title	:	Regulation of Kisspeptin and GnRH in reproduction of rohu (*Labeo rohita*) under varied environmental conditions
Project Code	:	E-81
Funding Agency	:	DBT
Duration	:	August, 2013 – July, 2016
Project Personnel	:	Ashis Saha (PI) and Lakshman Sahoo

Identification of two Kiss genes from an Indian major carp, *Labeo rohita*

Kisspeptins, encoded by the Kiss1 gene, have emerged as key modulators of reproduction in mammals. In contrast to the placental mammals, some teleosts express two Kiss genes, Kiss1 and Kiss2. In the present study, partial cDNAs of Kiss1 and Kiss2 in rohu were cloned and sequenced. For this study brain tissue samples were collected from an adult rohu. After collection of tissues, immediately frozen in liquid nitrogen and stored at –80°C until further use. RNA was isolated and cDNA was synthesized by reverse transcription. Primers were designed from the sequences available in the GenBank database and tried for amplification in rohu brain cDNA. cDNA fragments of 206 bp and 339 bp were amplified by the respective Kiss1 and Kiss2 primer (Figs. 21&22) , cloned into pGEM-T easy vector and sequenced. Blast result of Kiss1 cDNA sequence show significant similarity with cyprinus carpio (92%) and Kiss 2 sequence show significant similarity with *Carasius auratus* (96%) in the nucleotide level. Both the sequences were deposited in NCBI GenBank Database (accession number # KF737179 for Kisspeptin 1 and KF695115 for kisspeptin 2).

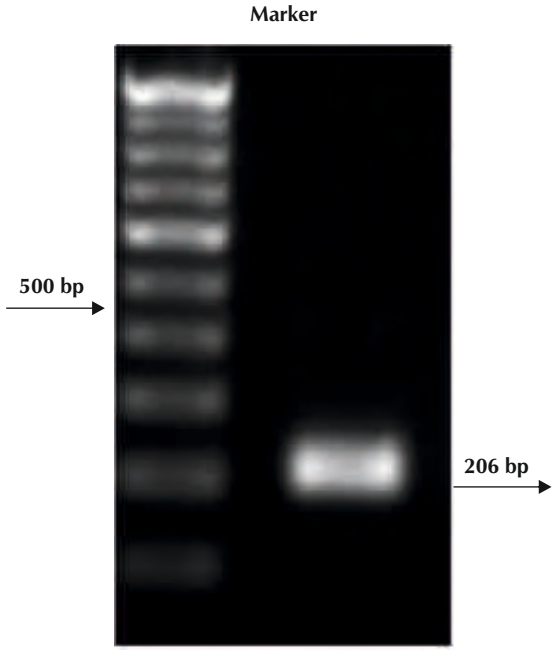


Fig. 21.RT-PCR products of Kisspeptin 1 primer with brain RNA.

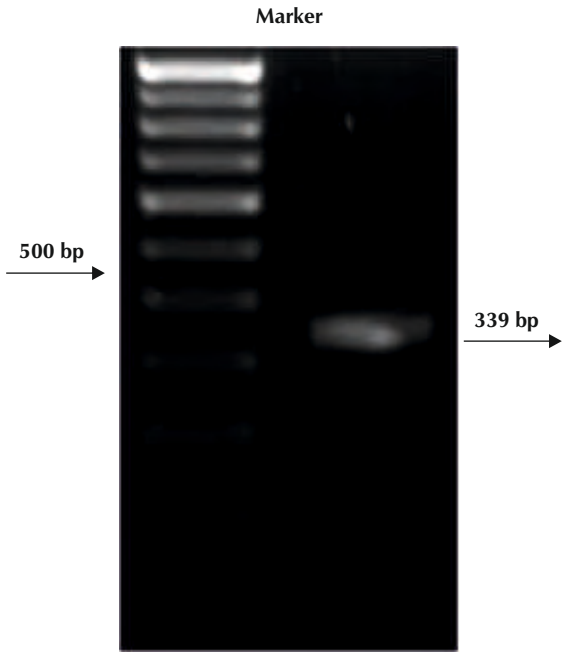


Fig. 22.RT-PCR products of Kisspeptin 2 primer with brain RNA.



OUTREACH PROJECT

Project Title	:	Outreach activity on Fish feed
Funding Agency	:	ICAR
Duration	:	April 2008- March 2014
Project Personnel	:	S. S. Giri (PI), P. K. Mukhopadhyay (upto 31.1.2013), P. V. Rangacharyulu, N. Sridhar, B. N. Paul, S. K. Sahoo, P. C. Das, K. N. Mohanta, S. C. Rath and D. N. Chotopadhyay

Hands–on training on farm feed preparation and floating feed management

Three off campus training on farm-feed preparation awareness and skill development was organized in Puri, Jagatsinghpur and Dhenkanal districts in collaboration of KVKs of the respective districts. Over 170 fish farmers were trained on farm-feed preparation. Training on economic and drudgery free use of the floating feed application is also provided to the farmers through demonstration and hands-on training programmes.

Development of an E-Learning module

As a part of the activity of the outreach project on Fish Feed "E-Learning on carp feed" is developed for knowledge dissemination programme. "E-Learning on Carp feed" provides information on fish feeds and answers on farmers quarries. Key tips operation of the lesson is made easy for farmers, field workers and students. One can move page to page by mouse or key board or to the selective text through contents page or link in content pages (Click) moves you for information or one can access information through links in queries page. The module contains 137 pages.

Feed Mill

Research on fish feed technology and training on fish feed production are the main output of the feed mill established in the institute. In addition, over 25 ton of floating feed and 1 ton of sinking feed pellet of different ingredient composition at desired size was produced and distributed among all the divisions of the Institute.

Enterprenure's training programme on "Fish Feed Production Technology" was organized at CIFA, Kausalyaganga, Bhubaneswar during 10-12 Feb. 2014. Eight entrepreneurs participated in this programme including 5 from North East States (Meghalaya). Training included class room teaching of theory and practical on fish feed production technology and hands-on training to formulate and prepare the fish feeds.

National Feed Testing and Referral Laboratory

Feeds, feed ingredients and fish tissue samples were analyzed in the laboratory. Some feed samples are received from state fisheries departments for evaluation.

Project Title : Outreach activity on nutrient profiling and evaluation of fish as a dietary component (CIFA Component)

Funding Agency : ICAR

Duration : April 2008 – March 2014

Project Personnel : B. N. Paul (PI), S. S. Giri and N. Sridhar

Fish samples of bata, pabda, tangra, chana, wallago, pangas, reba, calbasu and puntius of different weight ranges were collected from Barasat and Malancha fish market (North 24 Paraganas) and Rahara fish farm (CIFA). The fish samples were processed as per the common methodology developed under Outreach activity on Nutrient profiling Project for further analysis (Table 21-23).

Table 21. Proximate composition (% w/w basis) of different fish species

Species	Particulars			
	Moisture	Protein	Fat	Ash
Labeo bata	73.30-76.00	15.20-16.45	2.94-3.82	2.30-3.73
Labeo calbasu	75.66-76.34	16.52-17.62	1.73-2.53	1.41-2.71
Cirrhinus reba	72.73-77.51	13.30-16.49	4.95-6.33	2.01-2.37
Puntius sarana	75.34-76.37	14.64-15.22	3.82-6.41	1.89-2.58
Ompok pabda	72.44-73.02	18.45-18.85	3.09-3.94	1.89-2.15
Mystus vittatus	71.85-73.18	15.86-17.10	5.90-7.07	1.47-3.54
Channa striata	73.68-76.56	14.54-16.56	2.06-3.67	1.73-3.00
Wallago attu	71.73-75.72	15.02-18.14	5.20-7.72	1.43-1.82
Pangasius suchi	74.47-77.12	12.42-13.83	5.56-7.08	1.63-2.27

The moisture content of fish ranges from 71.73 to 77.51(%), protein content ranges from 12.42 to 18.85 (%), fat contains ranges from 2.06 to 7.72 (%) and ash content ranges from 1.41 to 3.73 (%).

Table 22. Fatty acid composition (%) of different fish species

Species	Particulars				
	SFA	MUFA	PUFA	EPA	DHA
L. bata	64.31	19.28	15.23	0.81	1.57
C. reba	27.03	51.22	21.75	3.91	ND
M. vittatus	71.09	8.66	20.15	2.50	4.42
O. pabda	24.70	54.58	11.41	ND	ND
C. striata	35.13	55.87	5.21	ND	ND
W. attu	13.40	66.00	15.92	1.28	2.21
P. suchi	37.75	40.15	21.89	2.09	0.98

SFA-Saturated fatty acid; MUFA-Monounsaturated fatty acid; PUFA-Polyunsaturated fatty acid; EPA-Eicosapentaenoic acid; DHA-Docosahexaenoic acid

Table 23. Mineral content (ppm) of different fish species

Particulars	Iron	Zinc	Copper	Manganese
C. reba	0.80-1.14	0.58-0.88	0.03-0.12	0.27-0.35
O. pabda	2.11-2.19	0.61-0.69	0.54-0.56	0.23-0.24
M. vittatus	1.83-2.83	0.74-1.93	0.83-1.26	0.21-0.25
C. striata	0.77-1.01	0.41-0.78	0.02-0.04	0.15-0.22
P. sarana	0.79-1.16	0.54-0.95	0.02-0.42	0.15-0.22

The iron, zinc and copper content are maximum in Tangra (*M. vittatus)* where as manganese content is maximum in Reba *(C. reba)*.

D. Fish Health Management

Project Title	:	Characterisation of bacteria of isolated from freshwater ecosystems
Project Code	:	E-49
Funding Agency	:	NBAIM, ICAR
Duration	:	2006 – March, 2014
Project Personnel	:	N. K. Maiti (PI) and S. Mohanty

Achromobacter xylosoxidans can grow by utilizing glucose, succinate and acetate as a carbon source and showed different nitrogen removal efficiency. Expression level of genes involved in different carbon utilization pathway has been studied by real time quantitative PCR and metabolic pathways related to carbon and nitrogen utilization have been identified. *Enterobacter cloacae* have been isolated from domestic wastewater. Bacteria can utilize up to 200 mg/l of hydroxylamine, 100 mg/l of ammonia, nitrate and nitrite in glucose as sole carbon source. A universal primer pair was designed to study the diversity of hydroxylamine gene from environmental samples. *A. xylosoxidans* and *E. cloacae* were applied in small-scale fish chamber (50 litre) in the form of Biofloc to study the nitrogen removal efficiency. *A. xylosoxidans* can remove 80 ug/l of ammonia in 8 days and *E. cloacae* could remove 90 ug/l of ammonia in 12 days after application of biofloc (Fig. 23).

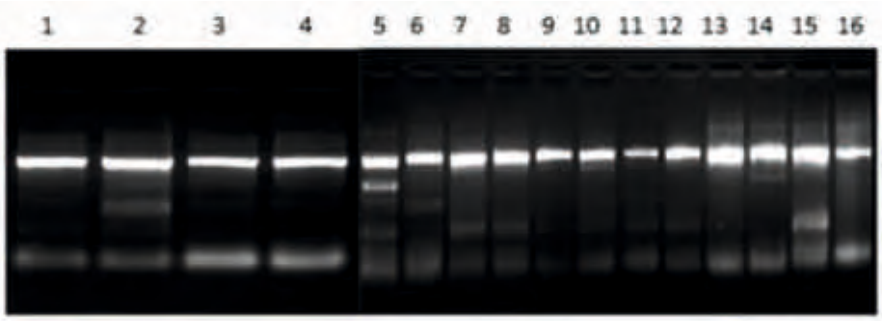


Fig. 23. Hydroxylamine reductase gene amplified by universal primer (1- Klebsiella pneumoniae CF-S9, 2- Citrobacter koseri, 3- Klebsiella pneumoniae, 4-Serratia marcescens, 5- Bacillus cereus, 6- Serratia marcescens, 7- Bacillus subtilis, 8 and 9-Soil DNA sample isolated from hot spring, 10- Soil DNA sample isolated from sea shore, 11 to 16- Soil DNA sample isolated from waste water sediments)

Project Title	:	Toll-like receptors in phylogenetically divergent fish species-their contribution in modulating the innate immunity (Component 4)
Project Code	:	E-53
Funding Agency	:	NAIP
Duration	:	January 2009- March 2014
Project Personnel	:	M. Samanta (CPI) and N. K. Maiti

The MyD88 functions as an adaptor molecule that transmits signal to downstream molecules from ligand activated TLRs by interacting with the TIR domains. We have predicted interface residues in TLR2-TIR domain with MyD88-TIR domain and the binding orientation and amino acid interactions generated by DS 2.5 were presented in Fig. 24(a).The phylogenies of interacted amino acids identified the strongly bonded residues and were highlighted in Fig. 24(b).

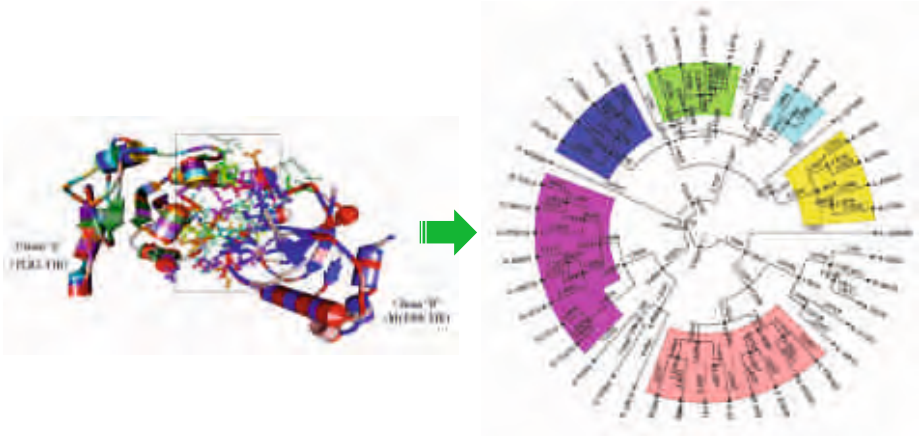


Fig. 24 (a&b). Interaction of TLR2-TIR and MyD88-TIR in Discovery Studio 2.5 (a) TLR2-TIR model is labeled as chain 'A' and MyD88-TIR model is labeled as chain 'B'. Interface residues are shown inside a rectangle box in ball and stick representation. (b) Clustering of interface residues between TLR2-TIR and MyD88-TIR domain in tree format. Residues of TLR2-TIR are marked as chain 'A' and MyD88-TIR as chain 'B'. Strongly interacting residues are highlighted with different colors.

The phylogenetic tree was created with full-length TLR protein of various species to understand their evolutionary relationship. The inferred phylogeny of the TLR gene family of fish and higher vertebrates showed two major clusters, supported by their high bootstrapping values. Cluster-I included fish, and the cluster-II denoted the higher vertebrates. Among the fish species, TLR2 protein in the cyprinidae family members viz., rohu, common carp and zebrafish were closely related and formed a subcluster, and were well separated from channel catfish, fugu, Japanese flounder, orange-spotted grouper, Antarctic ice fish and Emerald rock cod. Within the members of cyprinidae family, rohu TLR2 branched with common carp than zebrafish, indicating the close functional relationship of rohu and common carp TLR2. This tree topology was in agreement with the results of amino acids similarity and identity detected by MatGAT analysis. Among various fish species, TLR3 in the cyprinidae family (*D. rerio, L. rohita, M. amblycephala, G. rarus, C. carpio. C. auratus* and *C. idella*) formed a separate group. Among them, TLR3 of gold fish and grass carp were most closely related with 99.7% aa similarity and identity. Similar to rohu TLR2 and TLR3, phylogenetic tree of TLR5 gene family followed similar trend. Within cluster-I, rohu, common carp, grass carp, zebrafish, and channel catfish formed a sub-cluster (freshwater fish), and was well separated from other sub-cluster formed by fugu, Japanese flounder, orange-spotted grouper etc. Among the freshwater fish species, rohu TLR22 was closely related to common carp TLR22. The close evolutionary relationship of TLR22 between rohu and common carp may possibly indicate their functional similarity (Fig. 25).

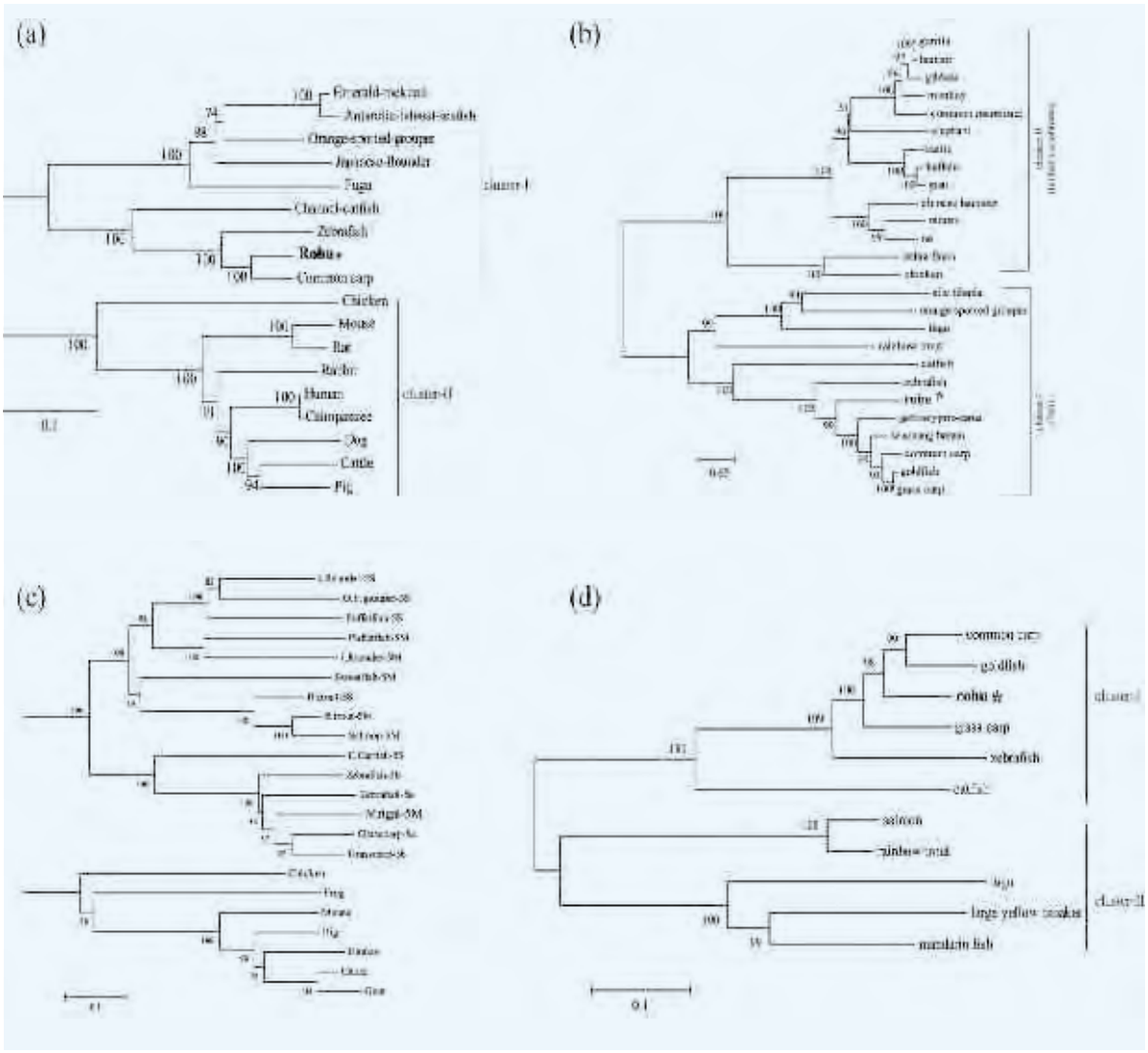


Fig. 25. TLR amino acid sequences were retrieved from the GenBank database and aligned using CLUSTALW. The un-rooted phylogenetic tree was generated by the neighbor-joining method within the MEGA4 program. The tree was boosted 1000 time and the percentages are shown. Phylogenetic tree of (a) TLR2 (b) TLR3 (c) TLR5 and (d) TLR22.

Project Title	:	Bioprospecting of genes and allele mining for abiotic stress tolerance
Project Code	:	E-58
Funding Agency	:	NAIP
Duration	:	June 2009-March, 2014
Project Personnel	:	N. K. Maiti (PI), S. Mohanty and M. Samanta

Denovo Whole Transcriptome Analysis of *Brevibacillus borstelensis* at 55oC for 5 min & 10 min was carried out. The mRNA, derived at 2 different time points after heat-shock, were converted into WTA libraries and sequenced on Ion Torrent PGM using 318 Chip. Total no of 4,979, 3,173 and 3,818 transcripts were generated for Bb_5, Bb_10 and Bb_50 *brevibacillus* samples respectively. Out of them 4,933 3,155 and 3,761 transcripts were annotated. Gene Ontology analysis performed by using Blast2GO software. Total no. of 1,833, 1,294 and 1,176 GO terms enriched were obtained for Bb_5, Bb_10 and Bb_50 samples respectively. Downstream analysis like Pathway analysis and Simple sequence repeat search(SSR) study carried out for all the samples transcripts. Based on the hit accession of functionally annotated transcripts in Bb_10 and Bb_50 samples, a total of 1,136 annotated transcripts was commonly identified in both the samples for differential expression analysis. Out of the 1,136 annotated transcripts, 227 transcripts were found to be significantly down-regulated while 909 transcripts were found to be significantly up-regulated. Based on the hit accession of functionally annotated transcripts in Bb_5 and Bb_50 samples, a total of 1,752 annotated transcripts was commonly identified in both the samples for differential expression analysis. Out of the 1,752 annotated transcripts, 193 transcript contigs were found to be significantly down-regulated while 1559 transcript contigs were found to be significantly up-regulated.

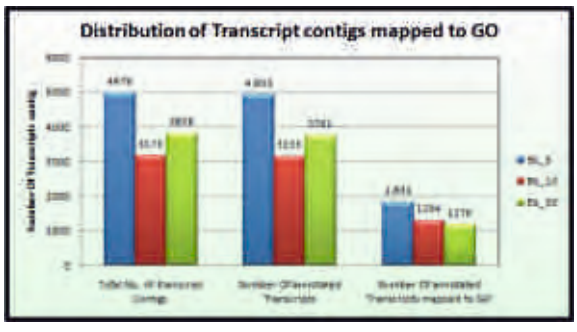


Fig. 26. Distribution of transcript contigs mapped to GO

Project Title	:	Intellectual property management and transfer/commercialization of agricultural technology (Up-Scaling of existing component i.e. Intellectual Property Right (IPR) under ICAR Headquarters Scheme on Management and Information Services)
Project Code	:	E-61
Funding Agency	:	ICAR XIth Five Year Plan Scheme
Duration	:	December, 2009- March, 2014
Project Personnel	:	P. Swain (PI), K.D. Mahapatra, P. Das, P. Routray, B. K. Das, N. K. Barik, A. S. Mahapatra and K. C. Das

Patent Filed:

1. "A method for identification and differentiation of two important argulus species *Argulus siamensis* and *Argulus japonicus*". Application No. 1108 / KOL / 2013 dated 26/09/2013.

Technology Commercialized:

1. **Immunoboost–C** was commercialized for second time for a period of 7 years to Smruti Agency, Bhubaneswar, Odisha with effect from 23 August 2013.
2. **CIFABROOD™** was commercialized for a period of 7 years to Aisharya Aquaculture, Naihati, West Bengal with effect from 29 August 2013.
3. **SHINING BARB** is transferred for 2 years field trail to Tropical Aquaculture & Farming Systems (India), A-104, Galaxy Apartments, Old Fatehpura, Bedla Roa, Udaipur-313001 with effect from 29 August 2013.

Revenue Generated

Technology Commercialized	Year (2013-2014)	Revenue
CIFABROOD	29/08/2013-28/08/2020	3, 11,000/-
Immunoboost –C	23/08/2013-22/08/2020	3,30,000/-
Total revenue generated		6,41,000/-

Project Title	:	The nature of impact of abiotic stresses on three diverse freshwater species of fishes
Project Code	:	E-70
Funding Agency	:	NFBSFARA
Duration	:	January 2011 – June 2014
Lead Institution	:	University of Delhi
Project Personnel	:	Rina Chakrabarti (PI) (DU), B. P. Mohanty (CCPI), CIFRI, M. Samanta (CCPI), CIFA, Bhubaneswar and Sasmita Mohanty (KIIT, Bhubaneswar)

In response to abiotic stresses like heat and cold stresses the expression of innate immune receptors (NLRC5, NLRX1, TLR5, TLR22) and their downstream molecules (IRAK4, TRAF4 IRF3) were investigated in magur (*Clarias batrachus*). TLR5 gene expression was significantly induced in liver, kidney, spleen and blood, whereas TLR22 gene expression was mostly up-regulated in liver following cold and heat stress. The expression of NLRC5 and NLRX1 gene was also up-regulated in the tested tissues following thermal stress. TRAF4 gene expression was significantly increased in all tested tissues, whereas induction of IRAK4 and IRF3 expression was mostly confined to liver (Figs. 27&28).

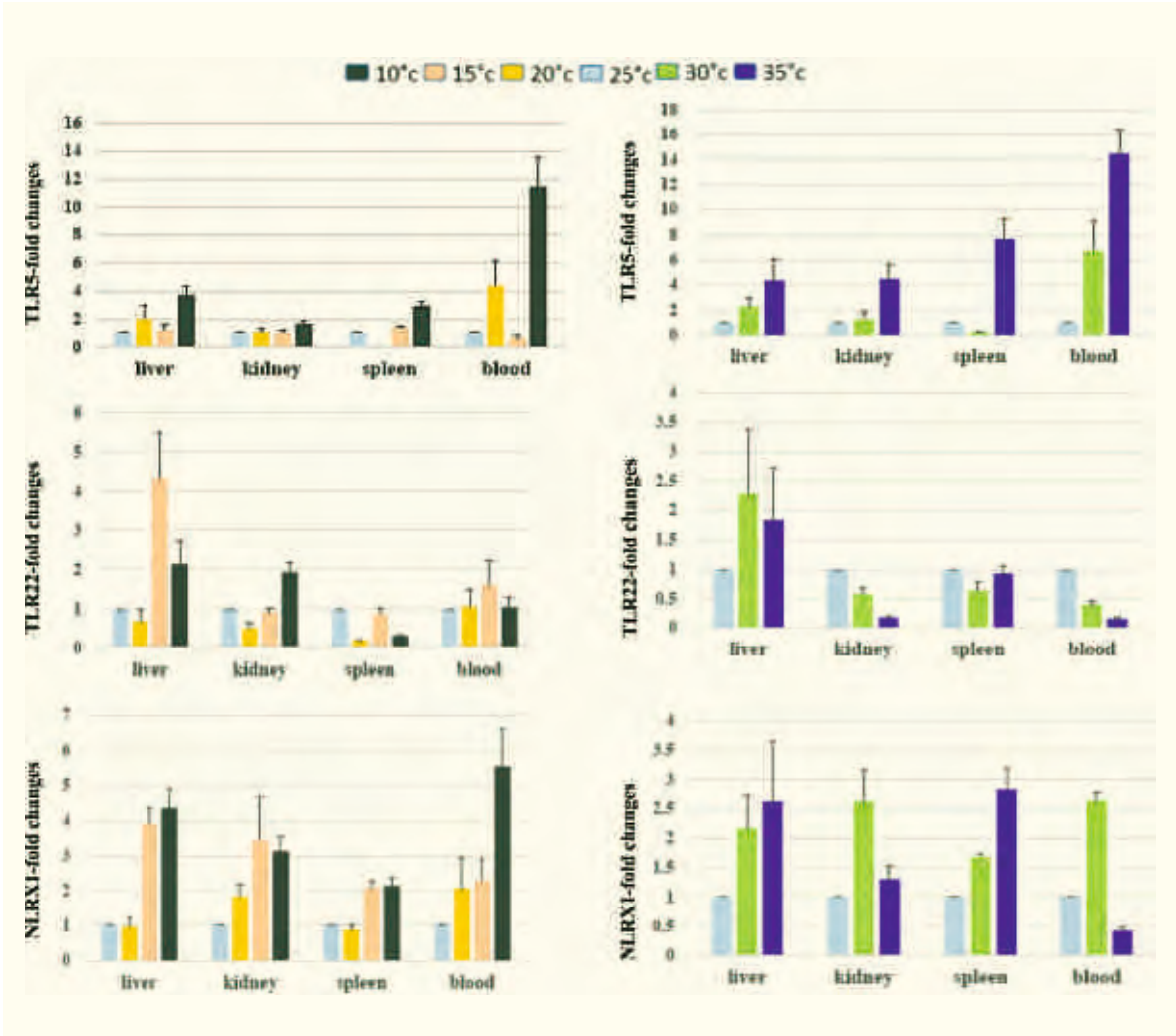


Fig. 27. Inductive expression of TLR and NLR genes following thermal stress

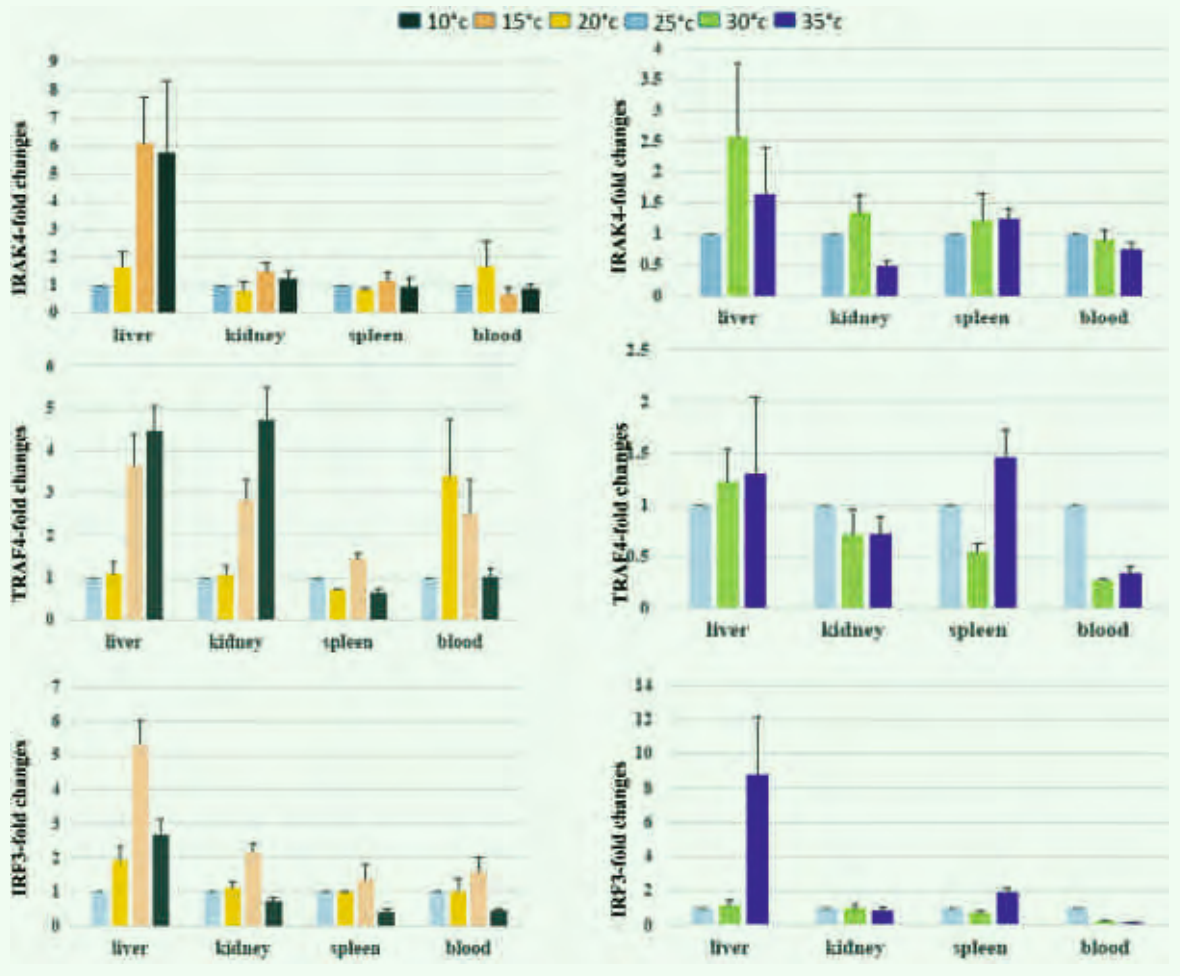


Fig. 28. Activation of TLR and NLR downstream signaling molecules following thermal stress

Project Title	:	Development of novel immunopotentiator molecules from fish host and pathogens for broad spectrum disease control in freshwater aquaculture
Project Code	:	E-71
Funding Agency	:	ICAR National Fellow
Duration	:	April, 2011 to April, 2016
Project Personnel	:	P. K. Sahoo (PI)

Cloning, sequencing and functional characterization of the IL 15 gene in *L. rohita*

IL-15 transcript of rohu was amplified partially, cloned, and sequenced. IL-15 showed early ontogeny in rohu being detected in unfertilized eggs, and fertilized eggs which continued up to 15 days post fertilization. IL 15 appears to be maternally transferred as it showed no expression in the milt samples (Fig. 29). IL-15 expression was detected in all twelve tissues of rohu examined except eye and gill; with high levels in spleen and intestine (Fig. 30). In an experimental study, the real time PCR based-expression analysis of IL 15 revealed significant up-regulation of the gene in kidney after *A. siamensis* infection. The expression was significantly down-regulated in case of *A. hydrophila* in liver but up-regulated in case of poly I:C induction and *A. siamensis* infection in liver.

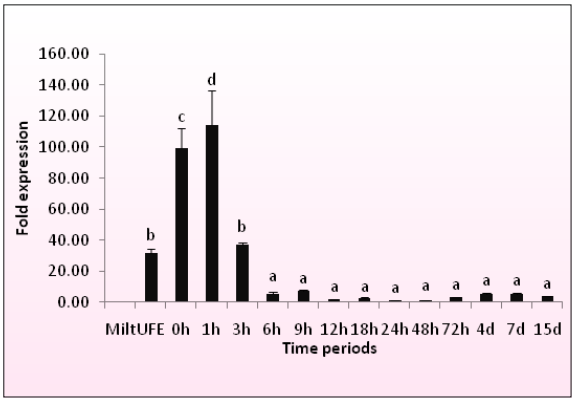


Fig. 29. Ontogenic appearance of mRNA transcript of IL-15 in rohu. (UFE, Unfertilized egg; 0-48 hpf and 3-15 dpf, hours and days post fertilization)

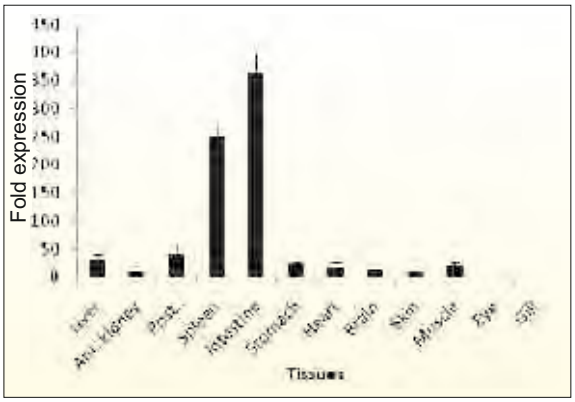


Fig. 30. Tissue specific expression of mRNA transcript of IL-15 in rohu.

Expression of Amps (antimicrobial peptides) in different infection models

ApoA1 showed a consecutively constant expression up to 12 h of post-infection with *A. hydrophila* in anterior kidney, a higher expression observed from 24 h to 72 h and that declined thereafter. Similarly, in liver tissue ApoA1 expression declined constantly from 0 h to 24 h and thereafter increased up to day 15. In case of poly I:C stimulated fish, the expression pattern increased up to 24 h of post infection and thereafter down regulated up to 15 d in anterior kidney. Similarly, in liver tissue up-regulation was observed at 12 h and 24 h of post infection and expression was decreased afterward attending a constant level in 15 d.

Antimicrobial property of recombinant ApoA1 and hepcidin against bacterial pathogens

Antimicrobial activity of recombinant APA1 and hepcidin was analysed by calculating minimal bacterial concentration (MBC) and zonal inhibition. The recombinant proteins of hepcidin and ApoA1 were able to inhibit the bacteria *Edwardsiella tarda* and *A. hydrophila* at a concentration of 54 μM and 100 μM, respectively, at 6 h post incubation.

Evaluation of vaccine efficacy of a novel antigen against *A. siamensis*

The ribosomal protein P0, in particular, is a promising vaccine candidate against several protozoa and bacteria. The full sequence information of P0 protein of the ectoparasite *A. siamensis* and the host *L. rohita* were obtained. The sequence of P0 from both the ectoparasite and the host were compared to find the region of least similarity which could be targeted to be used as antigen for vaccine development. A region of the parasite P0 protein was predicted between amino acids 285 and 310. A 20 amino acid region forming a peptide was obtained by chemical synthesis. The synthetic peptide was conjugated to KLH (Keyhole Limpet Hemocyanin). The vaccine potential of the said antigen was tested under an experimental study followed by parasite challenge. Though no significant difference was observed in the parasite load among the vaccinated animals; a mortality of 40% was observed in the non-injected control group after challenge and 20% in the peptide injected group. These preliminary findings suggest P0 might have role in protective immunity against *A. siamensis*.

Project Title	:	Nano-technology in aquaculture: an alternative approaches for fish health management and water remediation
Project Code	:	E-72
Funding Agency	:	ICAR National Fellow Scheme
Duration	:	April 2011 – March 2016
Project Personnel	:	P. Swain (PI)

Synthesis & Characterization of different metal nanoparticles

Magnesium and gold nanoparticles were synthesized from Magnesium nitrate and Chloroauric acid, respectively, by chemically as well as biologically from plant derived products and their size varied from 2-20 nm. They were characterized by UV- visible (UV-vis) spectroscopy, dynamic light scattering (DLS) and X-ray diffraction studies (XRD) (Fig. 31ab; Fig. 32ab; Fig 33ab).

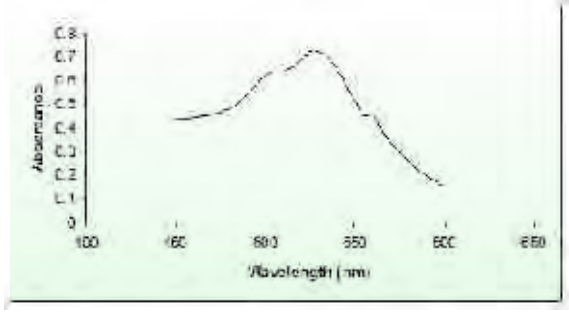


Fig. 31a. The UV-visible spectra of chemically synthesized gold nanoparticle showing peak at 530 nm

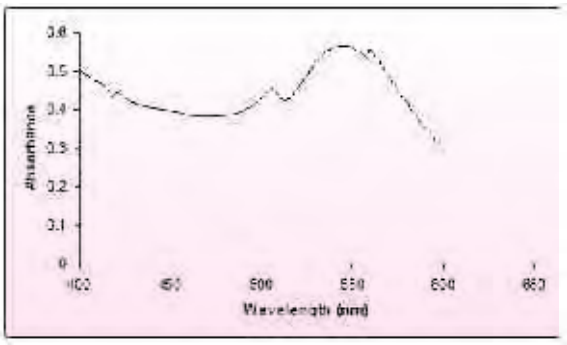


Fig. 31b. The UV-visible spectra of biologically synthesized gold nanoparticle showing peak at 545 nm

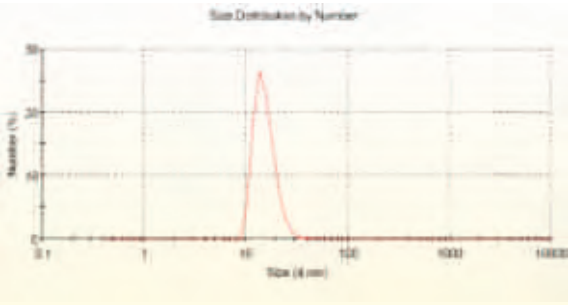


Fig. 32a. The average particle size of chemically synthesized gold nanoparticle determined by DLS was found to be 16 nm.

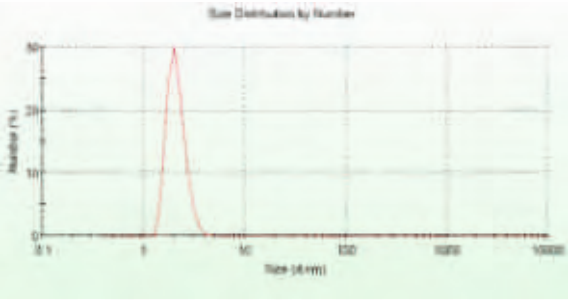


Fig. 32b. The average particle of biologically synthesized (plant 1) gold nanoparticle determined by DLS was found to be 2.11 nm

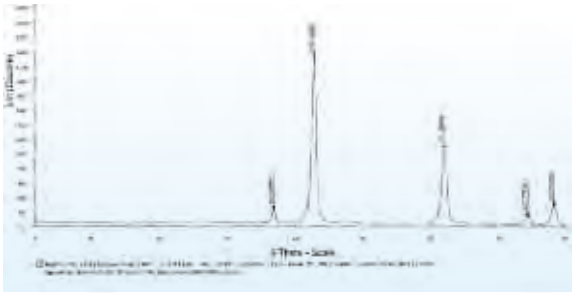


Fig. 33a. XRD spectra of Magnesium oxide nanoparticle synthesized from magnesium nitrate as the precursor molecule.

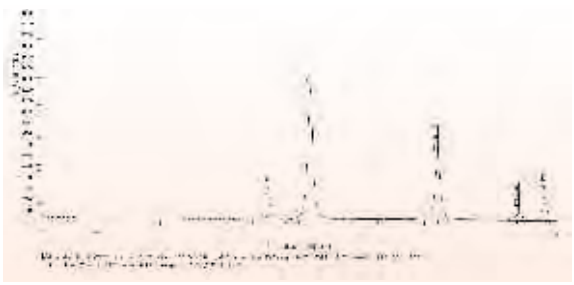


Fig. 33b. XRD spectra of Magnesium oxide nanoparticle synthesized from Magnesium sulphate as the precursor molecule.

Magnesium and gold nanoparticles were screened for their anti-microbial activities, against a wide range of bacteria and fungi. Both the nanoparticles failed to exibit any antimicrobial activities; however their other biological properties such as gene expression are being studied.

Water remediation activities of metal nanoparticles

The bioballs and ceramic rings were coated with laboratory synthesized copper oxide nanoparticles by mixing with polyurethane base. The coated bio balls and ceramic rings were experimented in small jars and aquaria containing seasonal pond water (Fig. 34a). Polymer paint containing graded doses of copper antimicrobial nanoparticle was coated on aquarium jars and tanks for estimating the microbial load and water parameters. They were found to reduce both microbial load as well as ammonia content of the water. Further laboratory and field studies are in progress.

Bioballs and ceramic rings, aquarium jars and tanks coated with copper oxide nanoparticles

Effect of dietary nanoparticles on immunomodulation

Dietary selenium nanoparticles could improve the final body weight, increases muscle selenium content and up regulated the expression of different immune related genes IL-1β and TNF-α in fish, *Labeo rohita* H. The selenium content in muscle was observed in two different trials T_1 and T_2 (16.42 ± 1.07 µg g^{-1} and 13.52 ± 1.31 µg g^{-1}, respectively) against the control (6.10 ± 0.78 µg g^{-1} dry weight). Glutathione peroxidase (GSH-Px) activities in liver tissues were significantly different with that of the control (Fig. 34a b).

Fig. 34 (a). Selenium nanoparticles

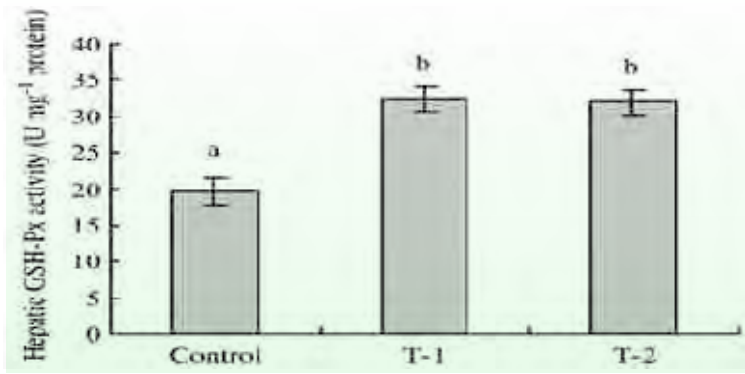


Fig. 34(b). Glutathione peroxidase (GSH-Px) activities of T_1 (selenium nanoparticles) & T_2 (Selenomethionine) treated groups in liver tissues of fish

Nanoparticles for fish muscle enrichment

Dietary supplementation of selenium nanoparticles (Fig. 35a) and iron nanoparticles (Fig. 35b) increases muscle selenium & iron content of fish, *Labeo rohita*. In addition both nano-Se and nano-Fe supplementation had a positive impact on the growth, innate immune function, haematological parameters and on the antioxidant status of fish. Nano-elemental Se & Iron showed high bioavailability and low toxicity as feed additives in fish. This suggested that fish can be consumed as major sources of selenium & iron for human health.

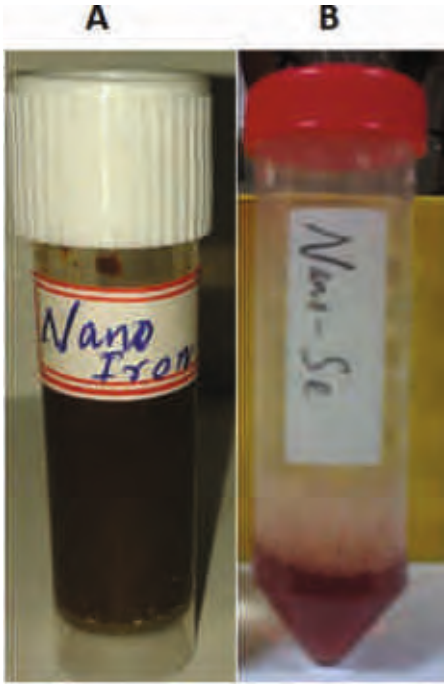


Fig 35 (a) selenium nanoparticles (b) iron nanoparticles

Project Title	:	Production of antiviral Mx protein in carps
Project Code	:	E-75
Funding Agency	:	DBT, Govt. of India
Duration	:	September, 2011 – August, 2014
Project Personnel	:	B. K. Das (PI), B. K. Mishra (up to 30.9.2012) and S. S. Mishra

All the three Indian major carps viz, rohu (*Labeo rohita*), mrigal (*Cirrhinus mrigala*) catla (*Catla catla*) of 50 to 100 g body weights, of unknown sex were used for induction of Mx gene by poly I:C administration. About 40 numbers of fishes were collected from CIFA farm and were acclimatized in 1000 l capacity cement tanks of the wet laboratory system, CIFA for a week prior to injection. During the experiment the fishes were fed with the commercial floating fish feed available in the local market.

Polyinosinic: polycytidylic acid (Poly I:C) was capable of up-regulating Mx expression in vivo, rohu, catla and mrigal were intramuscularly injected with 1mg of Poly I:C or the same volume of PBS in case of controls. Constitutive expression in different tissues like brain, heart, spleen, liver, head kidney, gill, muscle, intestine and blood for day1, day2, day 3, day4, day5, day7 and day14 were studied in experimental and control group of fish. In day 1 expression was maximum in spleen followed by liver, kidney, brain, heart, intestine, muscle, gill and blood in all the three major carps (Figs. 36&37). The expression of Mx was found maximum in fourth day in catla liver (Fig. 38).

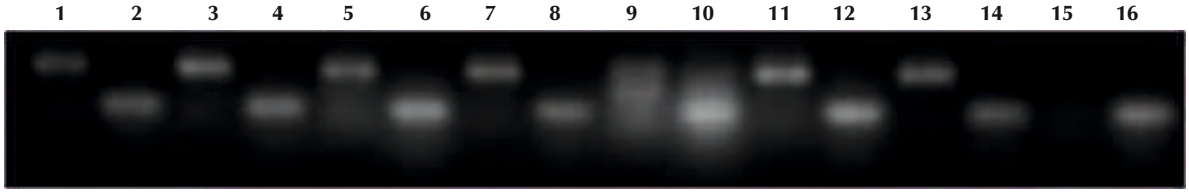


Fig. 36. Mx expression and β actin expression in different tissues of control fish Rohu

Lane 1β actin expression in brain , 2 Mx expression in brain, 3 β actin expression in heart, 4Mx expression in heart, 5 β actin expression in spleen , 6 Mx expression in spleen, 7 β actin expression in kidney , 8 Mx expression in kidney, 9 β actin expression in gill , 10 Mx expression in gill, 11 β actin expression in liver , 12 Mx expression in liver, 13 β actin expression in muscle , 14 Mx expression in muscle,15 β actin expression in blood, 16 Mx expression in blood.

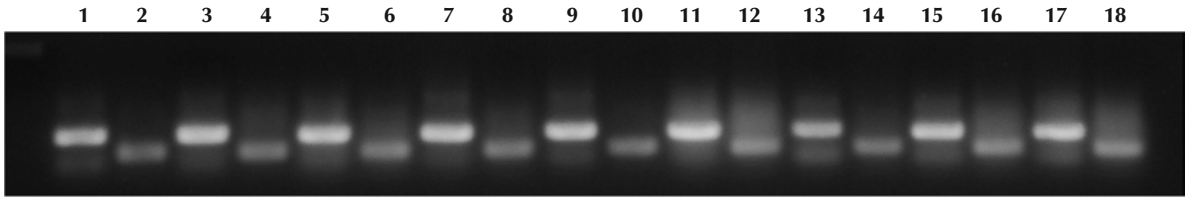


Fig. 37.Mx expression and β actin expression in different tissues of treated fish Rohu injected intramuscularly with 1mg of Poly I:C (1st Day)

Lane 1β actin expression in brain, 2 Mx expression in brain, 3 β actin expression in heart, 4Mx expression in heart, 5 β actin expression in spleen , 6 Mx expression in spleen, 7 β actin expression in kidney, 8 Mx expression in kidney, 9 β actin expression in gill, 10 Mx expression in gill, 11 β actin expression in liver, 12 Mx expression in liver, 13 β actin expression in muscle, 14 Mx expression in muscle, 15 β actin expression in intestine, 16 Mx expression in intestine, 17 β actin expression in blood, 18 Mx expression in blood.

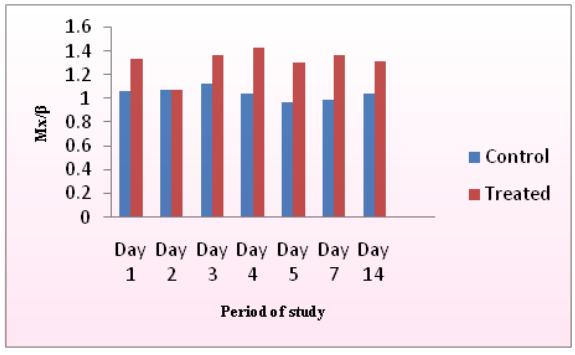
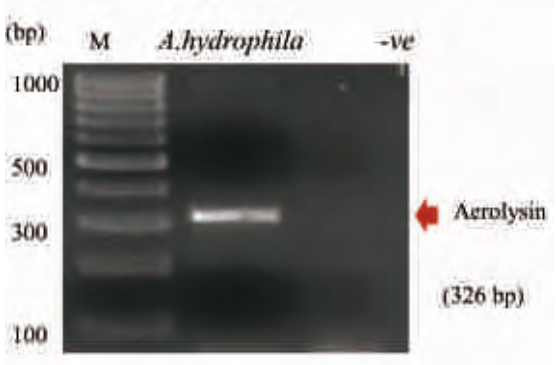


Fig. 38. Expression kinetics of Mx gene in liver of Catla as compared to β actin

Project Title	:	Diversity and synthesis of immunoglobulins in the Indian major carps
Project Code	:	E-83
Funding Agency	:	NFBSFARA
Duration	:	April 2013 – March 2017
Project Personnel	:	M. Samanta (PI)

Project Title	:	Development of PCR based diagnostics of *Aeromonas hydrophila* infection in freshwater fish species
Project Code	:	I-82
Funding Agency	:	Institute-based
Duration	:	April 2012 – March 2015
Project Personnel	:	M. Samanta (PI), B. K. Das and S. S. Mishra

PCR primers were designed to amplify virulence associated genes (aerolysin, hemolysin, GCAT, lipase, serine protease, OMP, Act, Elastase, gyrase-B) of *A. hydrophila*. Respective genes were amplified by PCR, and confirmed through cloning and sequencing. The specificity of detecting virulent *A. hydrophila* targeting these genes is under evaluation. (Fig. 39)



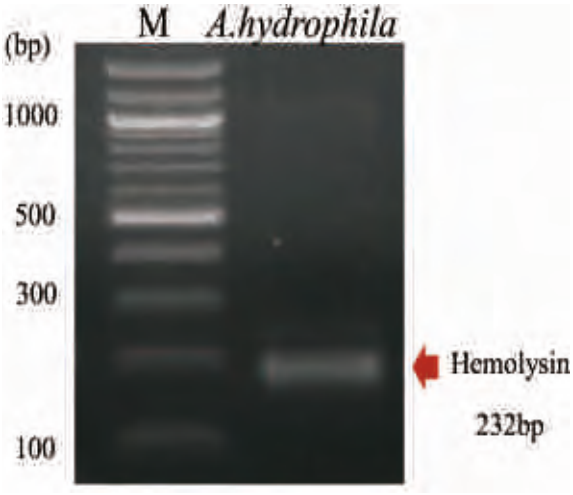


Fig. 39. Detection of aerolysin and hemolysin gene virulent *Aeromonas hydrophilla* by PCR

In rohu, immunoglobulin M, B-cell Activating Factor, CD22 genes were partially cloned and sequenced. Fishes were immunized with BSA and inactivated *A. hydrophila* proteins. Immunoglobulins were purified from immunized fish and were analyzed in SDS-PAGE. Tissue specific expressions of immunoglobulins were investigated following *A. hydrophila* infection. T-cell independent pathway of immunoglobulin synthesis was also investigated following TLR-ligands stimulation (Fig. 40).

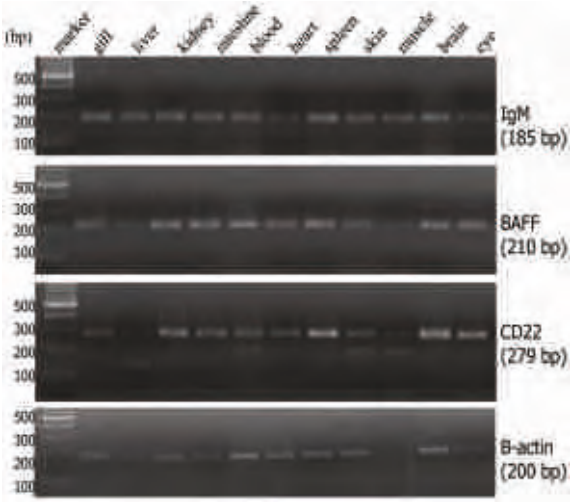


Fig. 40. Tissue specific expression of IgM, BAFF, CD22 gene

Project Title	:	National surveillance programme on aquatic animal diseases
Sub-Project 2	:	Surveillance of freshwater fish and shellfish diseases in Odisha and Andhra Pradesh)
Project Code	:	E-86
Funding Agency	:	NFBSFARA
Duration	:	April 2013 – March 2018
Project Personnel	:	P. K. Sahoo (PI) and B. K. Das

The districts covered for both passive and active surveillance were Jagatsinghpur, Cuttack, Puri, Khurda, Nayagarh, Sambalpur and Baragarh for the state Odisha and East Godavari, West Godavari, Krishna, Guntur and Nellore for the state Andhra Pradesh.

Total number of farms visited and farmers met

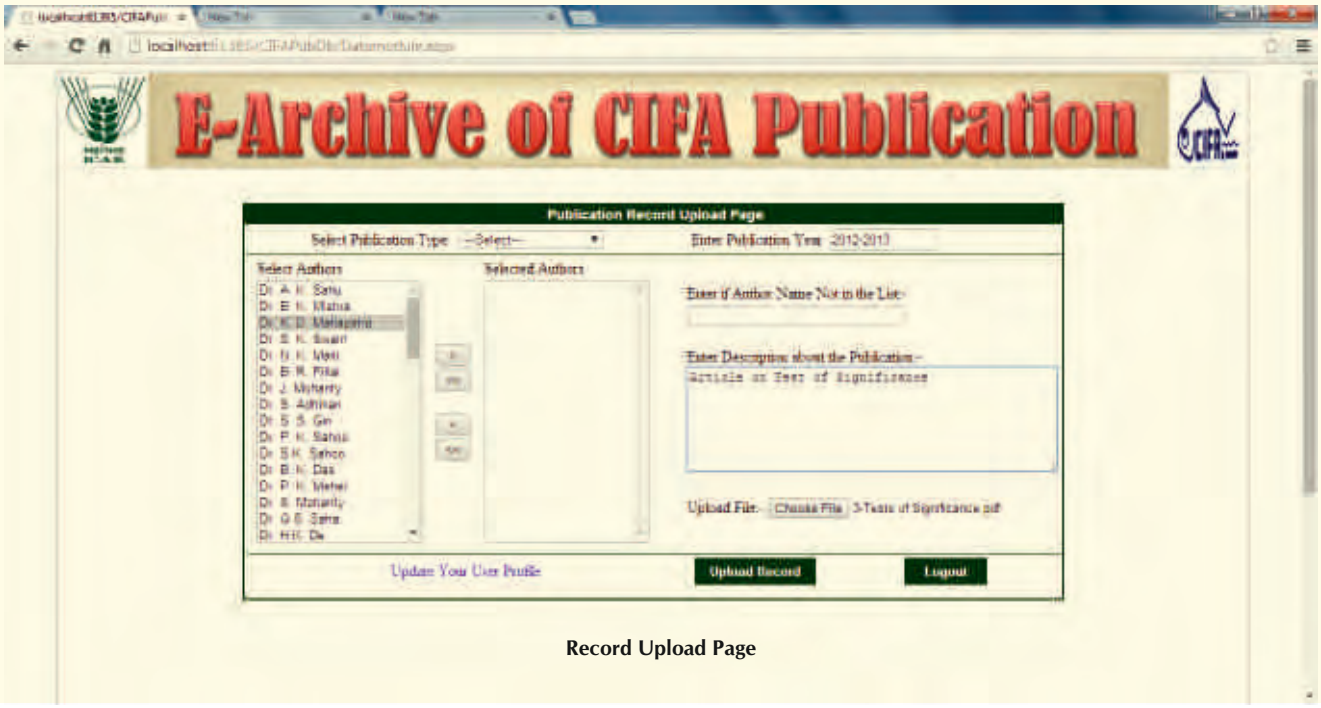
During the period, 9 farmers from Nellore, 11 from Guntur, 6 from Krishna, 4 from West Godavari, 5 from East Godavari districts of Andhra Pradesh, and 5 farmers from Jagatsinghpur, 5 from Cuttack, 10 from Kendrapara, 20 from Puri, 18 from Nayagarah, 10 from Khurda, 7 from Baragarh, and 10 farmers from Sambalpur districts of Odisha were contacted and visits were made to their farms to generate base-line information.

Meetings attended and organized

- Organized NSPAAD launch and sensitization workshop on 24 February 2014 at CIFA, Bhubaneswar
- Attended three Farmers-Scientists Interaction meeting at Jagatsinghpur, Cuttack and Bhawanipatna, Odisha
- Organized Farmers meeting at Nellore in Freshwater Farmers Association Office, ADF office, Kaikaluru, Krishna District, and at Fisheries Research Station, Undi (West Godavari) to sensitize officials and farmers about NSPAAD and its importance in aquaculture

Diseases reported and samples collected:

The farmers were mostly facing diseases like argulosis, other parasitic infections like *Costia* spp., *Trichodina* spp. and *Dactylogyrus* spp., red spot disease and bacterial septicaemia in fishes. The available medicines including pesticides are being applied for their control measures.



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E. Social Sciences

Project Title : Development of a database and information system for Institute's publications

Project Code : I-83

Funding Agency : Institute-based

Duration : April, 2012 – March, 2014

Project Personnel : A. S. Mahapatra (PI), G. S. Saha, H. K. De (up to July 2013), N. K. Barik, N. Panda and S. Mohanty

A digital achieve of institute based publications has been created by converting various types of institute based publication into electronic format and storing them into the database. Various types of Institute publication like Annual Reports, News Letters, leaflets, Pamphlets, Technical Bulletins etc. has being collected and converted into e-format in the form of PDF and records has been uploaded into the database. Facilities have been given to user with proper authentication to upload records related to various types of publication into the database. Users have to register first for uploading data into the database.

A logbook about user's activity is maintained to track down the activity of the users which helps to identify the types of publications uploaded by the users into the system. The database can be searched by Title, Author, Publication Types and Year wise.

Project Title : Aquaculture development through participatory approach

Sub-project title : Mainstreaming gender concerns in freshwater aquaculture development: An action research

Project Code : I-84 (a)

Funding Agency : Institute-based

Duration : April, 2012 – March, 2015

Project Personnel : P. Jayasankar (PI), B. B. Sahu, H. K. De (up to July 2013), Rajesh N., A. K. Das, N. Panda, U. L. Mohanty, P.N. Ananth, P. R. Sahoo, S. Behera and D. P. Rath

Under this project gender mainstreaming was achieved through women centric participatory development of aquaculture in the selected villages of Puri and Khordha district.

In Jaipur village (Satyabadi Block of Puri District) a total of five harvests were done till the month of June, 2013 with 6.75 quintal of carps including 1.5 quintal of trash fish. The size of carps varied from 500 g to 2 kg and total fish were sold at Rs. 50,000/-. After deducting labour charge and other expenses like liming and feeding of Rs. 22,000/, the net income was Rs. 28,000/-. Out of Rs. 28,000/-, Rs. 16, 200/- was distributed equally among the members each having Rs.200/-. Remaining Rs. 11, 800/- was saved in group's account for reinvestment in aquaculture activities. The income

benefits from the aquaculture as used for purchase of medicines, clothes and educational materials for their children. Some members also paid children's tution fees and spent on social functions.

In Paribasudeipur village (Balianta Block, Khordha district) in one of the pond (area – 0.6 acre) about two quintals of fishes were harvested. A part of the harvest was distributed among the members and the rest were sold for Rs. 8,000/-. The body weight of the fishes was in the range of 0.5 kg to 1.4 kg. The fish seeds were procured from CIFA hatchery and also from another hatchery of an N.G.O. named 'Udyog Bikash'. Loan taken from the group savings was used for personal expenditure and for entertainment purposes like horse dance, mela and other social work like road cleaning etc.

During September 2013, the team had a visit to Jaipur village, Satyabadi Block of Puri district and distributed three bags of ornamental fishes containing platy, black and white molly to the members of WSHGs. Stocking of ornamental fish in cement tanks and post stocking operations were demonstrated to the beneficiaries of Jaipur village.

SHG members watching documentary film

Demonstration of ornamental fish releasing into cement tank

Partial harvest in Jaipur village, Satyabadi Block, Puri district

The adopted villages were suffered severely due to cyclone Phailin during October 10-14, 2013. In Jaipur village, 500 beds of mushroom lost valued at Rs. 13,900/- (includes value of paddy straw, mushroom seeds, etc.). Fish feed of Rs. 80,000 (approximately) and 2 acres field of paddy were lost. Pond was overflown, fishes escaped and embankment was broken. In Paribasudeipur village, fish stock was completely lost. The project team visited the site and assessed the damage to aquaculture due to phailin.

Interaction with the group members

Table 24. Comparative performance in three adopted villages

Name of the villages	Culture period	Culture area	Weight range (kg)	Total yield (kg)
Paribasudeipur	8 months	1.5 acre	(0.5 - 1.4)	110
Fakirpada	8 months	1.5acre	(0.5 - 1.7)	150
Jaipur	8 months	4.5 acre	(0.5 - 2.0)	675

Sub-project title : Impact of catfish and murrel aquaculture in India

Project Code : I-84 (d)

Funding Agency : Institute-based

Duration : April, 2013 – March, 2016

Project Personnel : N. K. Barik (PI)

The project has the objectives to assess impact of three species i.e., magur, murrel and pabda on exante basis. The data from the early adopters will be taken as sample to build the impact assessment model. In the project the 6 numbers of farmers each from Odisha and Tripura were collected to assess the impact of murrel and pabda, respectively. The results from the data showed that under the monoculture condition murrel was able to generate profitability Rs 115/kg with production of 2.5- 3.0 t/ha. The farmers were maintained stocking densities of 10-15,000/ha. The selling price in Odisha was Rs 180/kg which was much less than the prevailing market price in the Northeasten, Northern and Western region of the country. There are scope to add a profit of Rs 50-70/kg by value addition through production of the fillet, finger or other value added products. In case of pabda, Tripura had taken lead in popularization of the fish with technical support from CIFA. At present 2 government hatcheries were producing pabda seed which was distributed to 250 farmers (150-200 nos/farmer). The Farmers were growing under poly culture condition which attained production of 625 kg/ha with the price of fish at farm gate price was around 300-350/kg. With the introduction of pabda, farmers are able to generate the additional profit of around Rs 1.87 lakhs/ha. These primary information will be used in the impact assessment model to assess the impact of these emerging species in next year.

Sub-project title : Study of dynamics of Aquaculture Field School

Project Code : I-84 (e)

Funding Agency : Institute-based

Duration : April, 2013 – March, 2015

Project Personnel : G.S. Saha, H.K. De (till July 2013), A.S. Mahapatra, N. Panda

The project was aimed at studying the dynamics of the aquaculture field school which would bring new insights into the innovative institutions that has shown promising results in the recent times. At Sarakana Aquaculture Field School group discussion was carried out to gain deeper insight into the functioning and behavioural dynamics of the users. The 'Participant observation' method was employed to understand how the 'sharing and learning' between the farmers takes place in AFS. Structured interview schedule for survey of beneficiaries is being developed for studying the impact of AFS. The study was carried out to analyse the types of fish farmers regularly visiting AFS. Trainee Officers of State Fishery Department and staffs of ATMA were made visit AFS to understand functioning of AFS. Preliminary observation was that AFS is the seat for practical learning, interaction and capacity building.

Factors contributed to the success of AFS are viz., positive attitude of the farmers towards AFS, self-motivated, trained & experienced lead farmer, informal / open practical learning ground, prolonged mentoring and support by CIFA and its scientists.

Project Title	:	Strengthening of digital library and information management under NARS (E-Granth)
Project Code	:	E-84
Funding Agency	:	NAIP
Duration	:	July 2013 – March, 2014
Project Personnel	:	A. S. Mahapatra (PI) and S. K. Mohanty

Open source library automation management software "KOHA" was successfully installed on Debian Linux Server. Data entry of all Books and Journals of CIFA was done. All Library data was uploaded in KOHA database both in local and central server. A two day National workshop on "Library Automation using KOHA Software" was held on 19th-20th March, 2014 at CIFA, Kausalyaganga, Bhubaneswar. One training Manual, three publication viz, KishiPrabha, Krishikosh, Agricat were released during the two day workshop. KOHA Software DVD were also distributed among the participants of the workshop.

Project Title	: Business, Planning and Development (BPD) centre for aqua-entrepreneurship
Project Code	: E-82
Funding Agency	: NAIP
Duration	: May 2013 – June, 2014
Project Personnel	: P. Jayasankar (PL), N. K. Barik (PI), P. Swain, S. Adhikari, P. Routray, B. C. Mohapatra, K. C. Das and P. N. Ananth

Business Planning and Development (BPD) Unit was set up in CIFA in June, 2013. To promote aqua-business entrepreneurs using aquaculture technologies; To facilitate technology commercialization of technologies developed by CIFA; To enhance human resource skill of entrepreneurs for aquaculture business. Seven entrepreneurs could come up to the stage and signed MoUs with BPD, CIFA for defining new orbit of their business and to move on. BPD is under discussions with another 26 prospective entrepreneur who are at different stage and some could reach to a stage of signing the MoU.

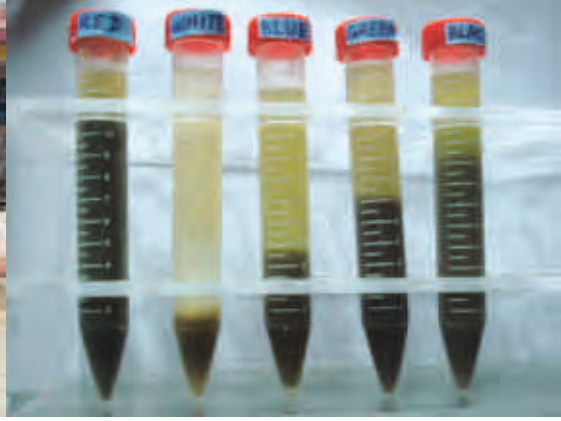
The BPD has developed value added fish product like rohu and catla deboned fish, fish fingers, fish pickle, fish fillet, fish biriyani, fish pickle etc. freshwater fish processing unit is developed and supported development of innovative product- fish hydrolysate. These products were test marketed in the Reliance fresh, Hotels, restaurant, etc. The BPD has generated revenue generation Rs. 9.0 (Rupees Nine lakh) through incubation services, consultancy.

Many new infrastructure and facilities developed viz., Tilapia hatchery, Murrel hatchery, Technology park, three numbers of ponds etc. The models of the technology viz, Magur hatchery, Carp hatchery, Demand fish feeder, Fish silos, etc are developed for display to the entrepreneurs. Office facilities of 3000 square feet is created which consist of technology display area, lobby, laboratory, incubate rooms, client consultation room, conference facilities, office space. This is in addition to 2000 square feet of space being used at present for the incubates and fish processing unit.

During this period four number of workshop viz, launching workshop, entrepreneurship meet, Workshop in CIFABROOD™, workshop on pre-commercialization of seven technologies was organized while the BPD has participated in the seven numbers of workshop, exhibition etc. The BPD has undertaken two number of consultancies i.e one from RRA- network at the cost of 5.2 lakhs and Agriculture Promotions and Investment Corporation of Orissa (APICOL) at the cost of 2.0 lakhs. One more consultancy at the cost of 2.0 lakhs is under discussion. The BPD has prepared nine fliers, one product catalogue, one leaflet and several posters and banner for business promotion in freshwater aquaculture.

Project Title	: Developing, commissioning, operating and managing an online examination system for NET/ARS-PRELIM examination for ASRB, ICAR
Duration	: April, 2010 – March, 2014
Funding Agency	: NAIP
Project Personnel	: P. Jayasankar and A. S. Mahapatra

The online ASRB examination system centre was made operational with the installation of 20 KVA online UPS, 100 computers along with Operating System and ANTI-VIRUS Software, configuration and testing of router, switches, One main server & One Back-up server, 10 Mbps broad-band internet connection. Seven High Density IP Based CCTV Camera on each Examination Hall and server room was also installed. During this period the system audit was also completed. Two mock online tests were successfully conducted before the first ASRB-Online NET 2014 examination. The first online ASRB, NET-2014 examination was successfully conducted from 26.03.2014 to 04.04.2014. Altogether there were 483 candidates allotted to CIFA Bhubaneswar centre from 55 disciplines.



F. Application of plastic in aquaculture

Project Title	:	Application of plastics in agriculture: Plant environmental control and agricultural processing
Project Code	:	E-03
Funding Agency	:	AICRP, ICAR
Duration	:	From May, 1988 and continuing
Project Personnel	:	B. C. Mohapatra (PI), B. B. Sahu, N. K. Barik, B. Sarkar (up to 26 June, 2013) and D. Majhi

Paniki - Indigenous fish cutting tool used for fish vending unit

The AICRP on APA centre at CIFA has developed a Mobile Fish Vending Unit looking into the problems faced by the retail vendors and consumers. This can be used for vending of 170 kg fish and its products at a time of the day. The Paniki (boti), which is an integral part of the vending unit, from Odisha, Bengal and Andhra Pradesh were evaluated for performance and drudgery by a group of 15 female and 15 male field workers in KVK (Khordha), Odisha. All the cutting devices are having blade length 18 to 20 inches. The curvature varies from 45^0 to 60^0. The Paniki of Odisha is found suitable for designing and cutting of large fishes due to its vertical design. The Bengal boti is very much suitable for fine cutting of fish due to its curvature; but, the efficiency of descaling of fish is less. Andhra Pradesh paniki is found suitable for cutting and descaling of small size fish.

Periphyton production on different colored plastic sheets in freshwater ponds

The experiment was conducted in the farm pond at CIFA, Bhubaneswar in triplicate with different coloured plastics, such as red, blue, black, green and transparent. After four months of observation, more periphytic growth in terms of volume was seen on red followed by green, blue, black and transparent plastic sheets under pond water. Number of genera established in colonies was seen more on green followed by blue, red, transparent and black sheets. 48 different periphytic microalgae were observed on the plastic sheets. More number of genera of green algae were found on the plastic sheets followed by diatoms, desmids and blue-green algae. The percent of occurrence of algae on green colour plastic sheet was not significantly different ($p > 0.05$) from white colour plastic sheet, but differed significantly from black, red and blue colour. It may be assumed that the colour of the substrate is effective for the specific or more algae. No significant differences ($p > 0.05$) were observed on the occurrence of the algae due to the colour of the sheet within individual groups except for diatoms, where blue colour sheet had significantly less number than white sheet.

Laboratory jar experiment for periphyton growth on different plastic materials

In laboratory glass jar were washed and each jar was filled with 15 liters of tap water and 10 liters of pond water, totaling to 25 liters of water. The water of each jar was fertilized by adding Urea (2.0 g) and SSP (3.0 g). The experiment was conducted in triplicate. Four types of plastic sheets were used for the experiment. Polyethylene (T-1, T-2, T-3), Polypropylene (T-4, T-5, T-6), FRP (T-7, T-8, T-9), Acrylic (T-10, T-11, T-12) sheets were immersed in the water of the jars. The experiment was conducted for 45 days. The FRP sheets were with higher periphytic coatings than other sheets. Quantitatively the amount of periphyton from 33 x 26 cm area was for FRP – 5.59 ml, acrylic - 2.79 ml, polyethylene – 3.03 ml, and polypropylene – 2.79 ml. Polyethylene sheet had more types of genera (Green algae) attached on to it and acrylic sheet had less type of genera. On all sheets, brown algae i.e., Bacillariophyceae (Diatoms) had developed and species Navicula was the dominant type. The experiment was repeated for the second time for its accuracy of the result. The water parameters were analyzed in an interval of 15 days.

Design and development of poly-tent drier for fish

Poly tent drier 8' x 8' x 6' has been designed using UV film of 200 micron. It is portable. Highest temperature recorded in a sunny day is 49.4 ^{0}C and lowest temperature 30 ^{0}C. Inside temperature of 43-45 ^{0}C is maintained for four hours. The poly tent drier dries maximum load of 200 kg fish silage of moisture level 75% to 30% in three days.

G. Field Station, Kalyani

Project Title : Production performance of some high value regionally preferred SIFS in integrated culture system comprising agri-horti-crops and livestocks integrated culture system

Project Code : I-80(f)

Funding Agency : Institute-based

Duration : April 2012 - March 2015

Project Personnel : P. P. Chakrabarty (PI), R. N. Mandal, D. N. Chattopadhyay, B. K. Pandey and S. C. Mondal

Integrated farming with high value crops (baby-corn, sunflower, hot season tomato)- Summer Crop Model (April, 2013- June, 2013)

A three months experiment was conducted during April-June 2013 where IMC viz., rohu, catla, mrigal was cultured with SIFs viz. *Gudusia chapra*. In the pond dykes, two summer seasonal crops viz., sunflower, babycorn were experimentally grown till harvesting. Water area and dyke area covered was 0.1 ha, 456 m2. rohu, catla, mrigal were stocked at 3:4:3 ratio and stocking density of IMC and SIFs were maintained at 10, 000 nos/ha. (Table 25&26, Fig. 41).

Table 25. Result of fish growth and survivability in 3 months

Fish Species	Initial average length(cm)/ weight (g)	Final average length (cm)/ weight(g)	Harvested (nos.)	Survivability	Production (kg)
Rohu	10.9/42.5	20.2 /212.0	223	74%	47.7
Catla	14.5/80.3	27.2 /320.5	323	80.7 %	103.5
Mrigala	12.3/32.5	19.5/170	195	65 %	33.15
SIFs *(G. chapra)*	7.5/5	10.7/ 20.47	601	60%	12.30

Total Production: Fish: IMC = (47.7 + 103.5 + 33.15) = 184.35 kg, SIFs = 12.30 kg

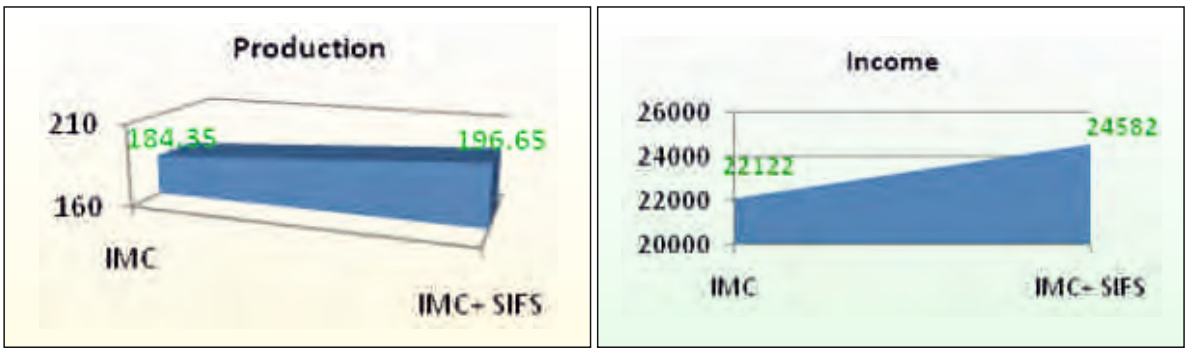


Fig. 41. Increased production and income by adding SIFFs in IMC Culture

Table 26. Production potential of two summer crops in pond dykes

Crop name	Area covered	Production	Remarks
Sunflower (oil seed)	228 m^2	371.64 kg	144.69 kg oil 200 kg oil cake
Baby corn (cob)	228 m^2	15048 nos	376.2 kg

Summer culture for a short period of 3 months in a summer experimental model utilising CFC(IMC)-SIFS *(G.chapra)*-High value horticulture crop (baby corn & sunflower) has resulted an incremental income generation as follows (Table 27, Fig. 42).

Table 27. Income potential

FISH	Crop	Area (m^2)	Production (kg)	Rate (Rs/kg)	Income (Rs)	
	IMC	1,000	184.35	120	22,122.00	24,582.00
	SIFS		12.3	200	2,460.00	
High value crop	Sunflower	228	144.63 (oil)	80	11,570.40	25,256.40
			200 (oil-cake)	12	2,400	
	Baby corn	228	376.2	30	11,286	

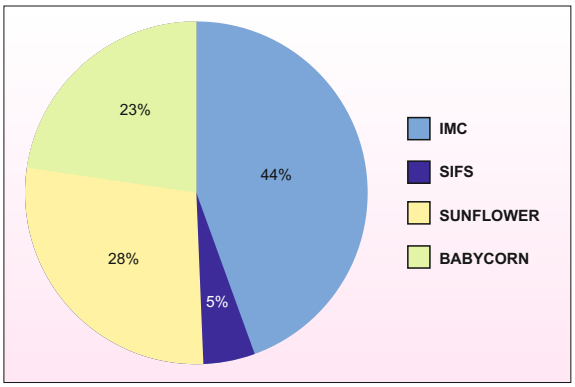


Fig. 42. Percentage of income generation from each crop

The experiment aimed at the utilisation of the total available area (land & water) with multiple cropping system, in effect judicious exploitation of diverse crops resources with maximum profit might return to household. SIFs which are highly priced and having higher growth rate can be stocked for a shorter period with the regular IMC fish species, without hindering growth of any species, has resulted in maximising production of fishes, with extra income of a household. Vacant land can be used to culture highly priced crops viz. sunflower and babycorn. Baby corn is a high value crop which is being sold at high rate in the market. Sunflower is also highly remunerative, oil extracted from oil seeds fully matured plant can be sold at good price at the market, and SOC i.e. sunflower oil cake can be used as source of protein rich component (41.5% crude protein, 36.9% digestible protein, FAO 1990) as feed ingredients for fish/ live-socks etc. Waste (available plant matter after harvesting) can be composted for production of compost for further application in manuring fish ponds and agricultural lands. The whole system can be treated as an example of an innovative integrated farming system comprising fish cum agri-horticulture.

Nutrient flow in integrated aqua-farming with duck (June-November 2013)

A six months experiment was conducted during June-November 2013 where IMC viz. rohu, catla, mrigal was cultured with SIFs viz. *Ompok bimaculatus*, along with ducks (Khaki campbell). Water area covered was 0.2 ha, ducks were kept at pond during day time and a 200 sq. ft duck house was constructed in the pond bunk for night shelter of the ducks. Rohu, catla, mrigal were stocked at 3:4:3 ratio and stocking density was maintained at 10, 000 nos/ha. Ducks 100 nos. (75 female, 25 male) layer was taken (Table 28).

Table 28. Result of Fish growth and survivability in 6 months

Fish Species	Initial L (cm)/ W(g)	Final L (cm)/ W(g)	Harvested (nos.)	Survivability	Final Production (kg) in 6 months
Rohu	12.10/35.00	32.50/430	451	75.16%	193.93
Catla	16.40/65.30	35.20/700.50	649	81.13%	454.63
Mrigal	13.90/30.25	24.30/300	370	62 %	111.00
SIFs *(O. bimaculatus)*	3.5/2.2	12.3/ 35.66	634	63.4%	22.60

Total Production :

Fish: IMC = (193.93 + 454.63 + 111.00) = kg

SIFs = 22.60 kg

Duck eggs obtained: eggs each 50- 55% female laid eggs.

Duck droplets were washed out into the pond from the duck shed which acted feed and fertilizer, thus no supplementary feed was added to the pond for fish feed.

Manure output from individual duck is about 3.88% of total live body weight of duck quantifying daily output from duck as 1.4 kg. Analysis for duck droplet gave the following result:

- Proximate values (average) of the manure has been analysed on DM Crude protein-7.53, fat-0.47, nitrogen-1.41, ash-22.36, moisture-67.72%.
- It has been estimated that one adult duck voids about 100-120g droplet per day (as such basis). Studies reveal that the adult duck droplet contains 1.22% nitrogen, 0.47% lipid and 22.36% ash.
- Total available nitrogen content of soil was initially 10 mg/100 g and further studies indicated that pond soil contained 20-30 mg/100 g nitrogen.

Therefore an integrated approach of duck-cum-fish culture may be remunerative.

Standardization of breeding of SIFs *(Mystus gulio; Ompok bimaculatus)*

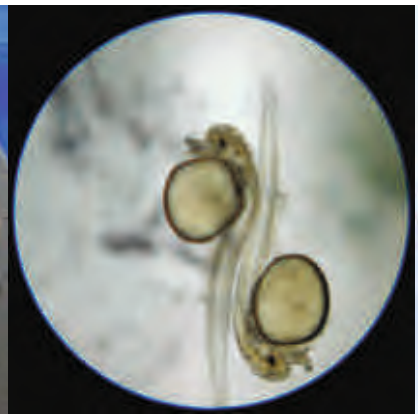
Adults of *M. gulio* were reared in freshwater pond at Kalyani Centre to raise brood stock for induced breeding. After a long trial, first success came in induced breeding of *M. gulio* through hypophysation during August 2013. Two females having average size 60 g/ 12.5 cm and four males having size 35 g/10 cm were taken for breeding.

Synthetic hormone was administered to the female @1.0 ml/kg and to male @ 0.2 ml/kg body weight. (Male and female ratio was 2:1). The injected fishes

released in a breeding hapa (2 m × 1 m × 1 m). Aquatic weeds (hydrilla) were provided in to the breeding hapa. About 300 spawn were recovered and their rearing is on progress.

- Spawning took place after 9 hours of administering hormone injection.
- Hatching took place after 18 to 20 hrs.
- Length of hatchlings (initial: 2 – 2.5 mm).
- Colour of hatchlings: almost transparent.
- Yolk sac: oval shaped.
- Food intake: 3rd day onwards.

Breeding of *O. bimaculatus* was done during August 2013 and about 1500 nos. fry size: 7 cm/12 g were produced.



Application of composted materials to fish ponds and agri-horticultural crops

After harvesting vegetable litters such as stem, leaf, etc. of high value crop viz., broccoli, red cabbage, cherry tomato, sunflower, baby corn, etc. were used for composting in order to recover misplaced nutrients contained in them. Before their use in composting, these waste substances were analyzed to get their nutrient status to make a comparative account in nutrient recovery between pre and post composting. The vegetable wastes exhibited the following nutrient status (Table 29):

Table 29. Pre-composting

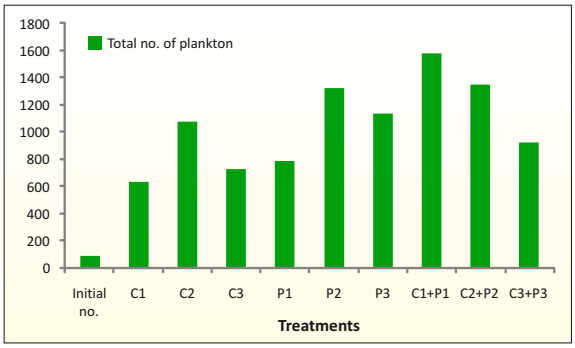
Crops	Moisture (%)	Organic matter (%)	Nitrogen (%)	Ash (%)	Potassium (%)	K_2O (%)
Broccoli	93-95	4.2- 4.5	0.04-0.06	1.43-1.60	0.08-1.0	0.03-0.05
Red cabbage	93-95	4.30 –4.50	0.02-0.04	1.3 -1.60	0.07-0.08	0.02-0.04
Cherry tomato	90-94	3.89- 4.20	0.032-0.500	1.2- 1.30	0.07-0.08	0.02- 0.04
Sunflower	90-92	4.1-4.3	0.05- 0.06	1.3-1.5	0.08-0.10	0.04- 0.05
Baby corn	90-93	4.4-4.5	0.03- 0.05	1.5-1.7	0.06- 0.08	0.03-0.06

Compost was made following the standard procedure with cattle dung used as starter. The fermentation took place in 3 month to complete the whole decomposition process followed by collecting compost readily made for use in both aquaculture and agriculture practices. The nutrient content of compost as taken from different layers reflected viz., Nitrogen 2.32-2.50%, Ca 3.72-4.39%, Potassium 1.1-1.5% and K_2O 1.8-2.05%.

Culture and growth performance of fish by utilizing various livestock wastes

An experiment was conducted for plankton production in confined condition (FRP tank) using different wastes such as cattle dung, poultry litter and their mixture with equal proportion, each with three treatments carried out for 90 days duration. Three treatments were set up with respective doses applied @0.005 kg/100 liter water/week, @ 0.008 kg/100 liter water/week and @ 0.011 kg/100 liter water/week. Mixture of cattle dung + poultry litter @ 0.005kg (cattle dung, 0.0025 kg + poultry litter, 0.0025 kg) exhibited the best performance in producing plankton measuring 1580 numbers L-1 among other treatments. The dose (0.005 kg /100 liter water) of waste mixture correspondences to application of 500 kg/ha/yr water area. The experiment suggests that combination of cattle

dung and poultry litter may be applied in fish pond so as to increase the production of plankton at desirable level required for maintenance of pond water sustainability pertaining to water productivity and live food to fish (Figs. 43&44).



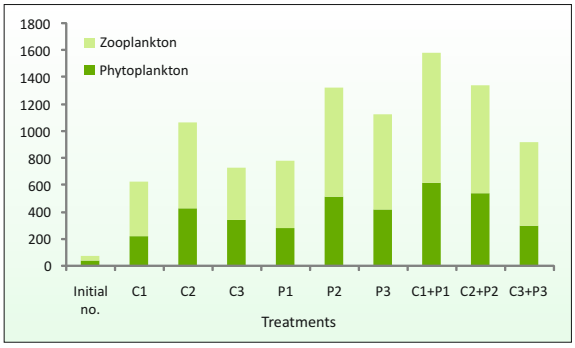


Fig. 43 & 44 Production of Plankton *vis-a-vis* under different organic manures applied in fish pond

Identification of marketing chain in incorporation with high value crops

A study on integrated farming system with high value agri-horti & pisciculture results shows that high value crops have sufficient potentiality to give a moderate income to the farmers. It has been seen that in India most of the farmers are under marginal and small category. A problem has been identified that this high value crops do not have sufficient demand in the local market away from Kolkata and maximum people do not have any knowledge about their importance of consumption so, many of them refuse to buy this crops instantly. As a result poor farmers have to depend on the middleman who are taking this high value crops in an around Kolkata for hotels, restaurants and shopping malls. Thus farmers became deprived to get their actual profit (Table 30).

Table 30. Market demand of high Value crops in some market

Name of crop	Demand in Market					
	Kalyani, 2 nos. market	Madanpur, Nadia	New market, Kolkata	Keventer Fresh, Barasat	Metro Cash & Carry in Kolkata	S.S. Hogg Market, Kolkata
Broccoli	+	-	+	+	+	+
Red cabbage	-	-	+	+	+	+
Chinese cabbage	-	-	+	+	+	+
Capsicum	+	+	+	+	+	+
Lettuce (Ice-berg)	-	-	+	+	+	+

+ indicates demand in market ; - indicates less demand in market

Some reputed market in Kolkata an in different shopping malls have been seen that this crops have a sound market demand during the survey in the nearby markets of Kolkata, it was seen some middleman, collects this high value crops from few farmers in cheap rate and sales to the retailer in comparatively high price. During the survey it also revealed that middleman has a specific channel through which they are connected with retail stores those are buying this high value crops comparatively higher price than the farmers, If farmers sells directly to retailer then the profit increased by 40% to 80% (Table 31).



Table 31. Selling chain of high value crop

Crops	Farmers Selling Rate Rs (Approx.)	Middleman Selling Rate Rs (Approx.)	Retailer Selling Rate Rs (Approx.)	Consumer Getting Rate Rs (Approx.)
Broccoli	12/pc	16/pc	18-20/pc	20-22/pc
Red cabbage	17/pc	20/pc	22-23/pc	24-25/pc
Chinese cabbage	15/pc	18/pc	20/pc	22-23/pc
Hybrid Chilly	50/kg	55/kg	58-60/kg	60-65/kg
Capsicum	70/kg	75/kg	77-80/kg	80-85/kg
Lettuce (Ice-berg)	12/pc	15/pc	18-20/pc	22-25/pc

Dissemination of technologies to farmers' field

- The strength of research finding of this innovative IFS model attracted several dignitaries DG, DDG(Fy), Dr. A.E.Eknath, DG, NACA, Thiland, Dr. S.D.Tripathy, Ex-VC CIFE, Dr. M. R. Sinha, ex director CIFRI, FAO consultant and many others, finally Dr. B. Gangwar, Director PDFSR came forward and approached to Director to have collaboration with CIFA for active collaborative work among AICRP centres and CIFA, Kalyani for propagation of this highly acclaimed innovative FSR and has signed a MoU for strengthening inter institutional linkage between PDFSR and CIFA on 9 January, 2014.
- Various fish farmers of Bali island Sundarban, Shibdaspur, Naihati, of Dist- South 24 parganas and Fulia, Dist- Nadia, West Bengal has started cultivation of high value crops in their pond dykes, duck –cum fish culture.

Project Title : Stock characterization, captive breeding, seed production and culture of hilsa *(Tenualosa ilisha)*
Project Code : E-78
Funding Agency : NFBSFARA
Duration : November, 2014 – November, 2017
Project Personnel : D. N. Chattopadhyay (CCPI), CIFA; V. R. Suresh (PI), CIFRI (CO-PIs: B. K. Behera, R. K. Manna, Sajina A. M., K. M. Sandhya); S. Dasgupta (CCPI), CIFE (CO-PI: G.H. Pailan); R. Ranjan (CCPI), CMFRI (CO-PI : S. Ghosh, B. Dash); D. De (CCPI), CIBA (CO-PI: S. Anand); V. Mohindra (CCPI), NBFGR (CO-PIs: K. K. Lal, R. K. Singh, S. Mandal, J. K. Jena); S. Bhattacharya (CCPI), VBU (CO-PIs: S. Saikia, R. Kundu).

Survey of River Hooghly

A total number of 47 sites in an around river Hooghly from Godakhali to Farakka were surveyed. Availability of brood fish and seed of hilsa *(Tenualosa ilisha)* are given in Tables 32&33. Males were found with freely oozing condition. The number of fully mature females ready for spawning was very few. The numbers of hilsa seed caught per day in different months are given in Fig. 45.

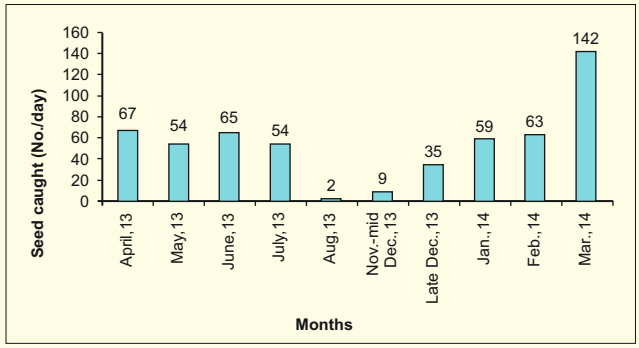


Fig. 45. Average number of hilsa seed caught per day in the region between Tribeni and Hooghly Ghat

Table 32. Availability of brood fish in different months.

Months	Area	Brood availability	Available size	
			Male	Female
April First week 13	Bolagarh to panihati	Male & female are 1:1	313 mm/283 g	332 mm/389 g
May-July 2nd week	Bolagarh to Chinsurah	Poor availability		
July end- Aug end	Bolagarh to Dhakhineswar & Godakhali	Mature male dominates	271 mm/210 g	352 mm/830 g
Sept. 13	Godakhali	Both mature male and female.	291 mm/268 g	335 mm/488 g
Oct, 13	Balagarh and Hooghly ghat	Only mature female was available and availability of male is negligible.		
Mid Nov.- Mid Dec.	Farakka (beniagram stretch, Padma side of Farakka barrage)	While all the males were in milting condition the females were not found in fully ripe condition except one.	231.95 mm/130.63 g	244.43 mm / 200.71 g
	Tribeni to Hooghly Ghat	No brood fish was available		
Mid Dec. –Mid Jan. 14	Bolagarh to Hooghly Ghat	No brood fish was available		
Mid Jan.-Mid Feb. 14	Bolagarh to Hooghly Ghat	Brood was rarely available		
From Mid Feb. 14 – March 14	Bolagarh to Naihati & Godakhali	Both male & female brood (mostly small & not ripe) became available.	299.18 mm/258.92 g	354.63 mm / 612.75 g

Table 33. Month wise available size of hilsa seed in the area between Tribeni and Hooghly ghat

Month	Size Range	Average Size
April 2013	17-148 mm / 0.23-27 g	56.64 ± 3.46 mm / 2.75 ± 0.66 g
May 13	28-118 mm / 0.25-18.3 g	50.81 ± 0.67 mm/ 1.48 ± 0.1 g
June 13	43-96 mm / 0.4-7 g	56.22 ± 2.69 mm / 1.60 ± 0.31 g
July 13	23-60 mm / 0.2-1.51 g	45.14 ± 1.03 mm / 0.69 ± 0.03 g
August 13	35-40 mm / 0.31-0.5 g	37.5 ± 2.5 mm / 0.41 ± 0.1 g
September 13		Not found
October 13		Not found
November 13		Few in numbers
December 13		Few in numbers
January 2014	54-81 mm / 1.3-4.6 g	67.55 ± 1.74 mm/2.66 ± 0.2 g
February 14	58-79 mm/1.1-6.68 g	68.66 ± 2.06 mm/3.26 ± 0.34 g
March 14	70-116 mm/3.09-15.05 g	91.01 ±2.08 mm/7.28 ±0.5 g

Artificial breeding of hilsa

Hilsa (*Tenualosa ilisha*) could be successfully bred by dry stripping in Hooghly River at Godakhali. Fully matured female showed freely oozing yellow colored eggs. The matured male had freely oozing white colored milt. Breeding trials conducted in different times are given in Table 34.

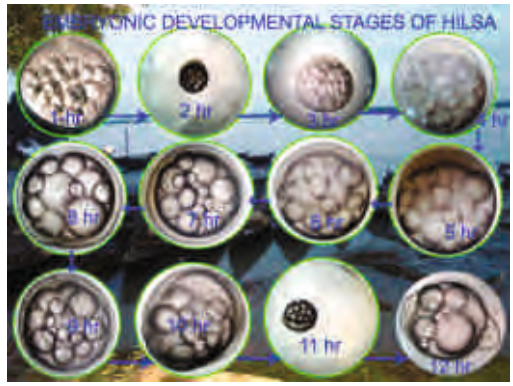
Table 34. Hilsa breeding trials

Date of trials	Place	Wt. of female (kg)	Wt. of male (kg)	Method used	Fertilization (%)	Observation
24.8.13	Godakhali	0.65	0.45	Wet Stripping	35	Few larvae hatched and survived up to 3 days.
5.9.13	Godakhali	0.5	0.35	Wet Stripping	10	Embryonic mortality occurred after 9 hrs.
22.9.13	Godakhali	0.64	0.15 – 0.25	Dry Stripping	93	10,000 hatchlings were produced (estimated) and larvae survived up to 10 days.
8.12.13	Farakka	0.13	0.11 – 0.12	Dry Stripping	14	Embryonic mortality occurred after 10 hrs.
22.2.14	Godakhali	0.21 & 0.34	0.22-0.3	Dry Stripping	95	73,000 hatchlings were produced (estimated) and 40 fry was alive in FRP tank at their 36 days of age. Rearing is in progress.

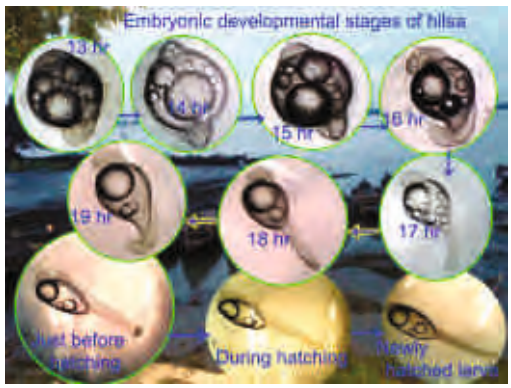
Characteristics of eggs, embryo and yolk sac larvae of hilsa (*Tenualosa ilisha*)

Swelling of eggs started just after sprinkling and adding water on the mixture of egg and milt. The fertilized eggs are spherical and transparent having yellowish yolk with numerous oil globules. The unfertilized eggs are having whitish yolk which can be easily differentiated from the fertilized eggs. Fully swelled fertilized eggs were observed after 45 minutes of stripping. The average diameter of fully swelled eggs varied from 1.7-2.1 mm. The developmental stages of embryo and larva of hilsa are given below.

Hilsa breeding trial at Godakhali



Embryonic developmental stages of Hilsa (1-12 hour)



Embryonic developmental stages of Hilsa (13-19 hour)

Larval stages of Hilsa (1-10 day)

Egg incubation and hatching

Fertilized eggs were incubated under room condition in plastic tubs, aluminium handi, rectangular trays and glass petridishes as well as in hapas fixed in pond. Embryonic mortality was 100% in hapa at 9th hour probably due to sudden depletion of DO level in pond from initial 7.8 mg/L to 4.8 mg/L.

Two trials were conducted on hatching rate of eggs at different temperatures using different waters in glass petridish each with five replicates (Table 35). In Trial 1, hatching started at 19th hr. and completed at 22nd hr. after fertilization while in Trial 2, hatching started at 25th hr. and 38 minutes and completed at 30th hr. after fertilization.

Table 35. Hatching rate (%) of hilsa eggs at different temperatures and waters

Trial 1	Parameters	River water	Pond water	Tap water
	Hatching (%) at 22.6-23 ^{0}C	76 ± 5.1^{a}	96 ± 2.45^{b}	74 ± 2.45^{a}
	Hatching (%) at 28-28.5 ^{0}C	70 ± 3.16^{a}	88 ± 2^{b}	72 ± 3.74^{a}
Trial 2	**Parameters**	**River water**	**River water + Tap water (1:1)**	**Tap water**
	Hatching (%) at 17.3-22.8 ^{0}C	56.67 ± 8.82^{a}	65.00 ± 5.77^{b}	81.67 ± 1.67^{c}

Rearing of yolk sac larvae

Trial-1: During the month of September 2013, the hatched out yolk sac larvae of 10-hrs age were transported from Godakhali to Kalyani Centre at night and were incubated them in glass aquaria, glass battery jar and FRP tank with continuous aeration system under laboratory condition. From 6th day onwards larvae were supplied with rotifer which were collected from farm pond and filtered by bolting silk cloth (200 micron or 0.2 mm) to allow passing the small rotifers only (< 200 micron size). The larval length is given in Fig. 46. The larvae survived up to 10 days.

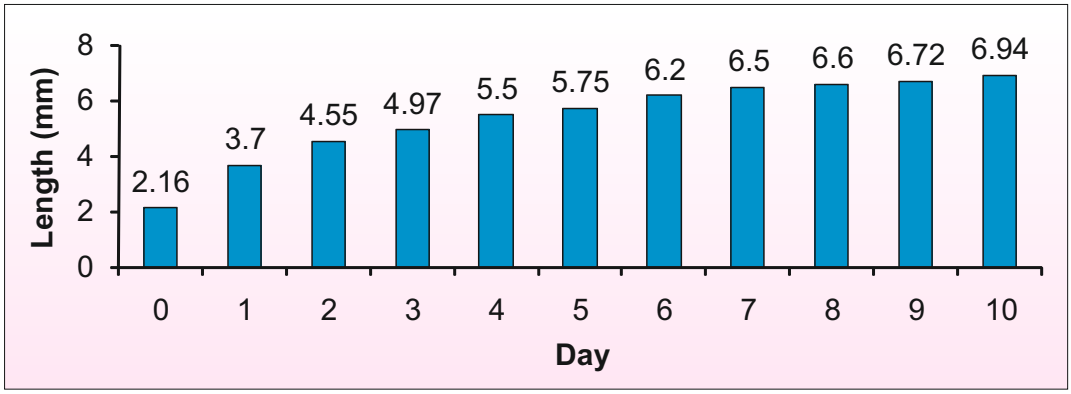


Fig. 46. Average length of hilsa larvae at different days (0 days represents newly hatched larvae)

Trial-2: During the month of February 2014, the stripped eggs were hatched out near the breeding site at Godakhali and the hatched out yolk sac larvae of 1-hr age were transported from Godakhali to Kalyani Centre at night. The larvae were initially reared for 10 days in three environmental conditions with three replicates for each. These are rectangular FRP tank (3 X 1 m) filled with sieved water of Hooghly river, nylon bolting silk hapa fixed in 0.01 ha freshwater nursery pond and nylon bolting silk hapa that were kept in floating condition with the help of PVC frame and empty jerricans in 0.1 ha stocking pond. Mechanical aeration and 0.3 meter depth was maintained in all these rearing system. After 10 days of rearing, only 200 and 250 larvae could be recovered from FRP tanks and floating hapas, respectively. The larvae did not survive in fixed hapas.

Rearing of 10-day larvae

The 10-day old larvae were again stocked @ 17 nos./m2 in nine rectangular FRP tank (3 X 1 m) having sieved pond water in three depths of water viz., 0.3, 0.6 and 0.9 meter each with three replicates. In each tank mechanical aeration and flow were maintained. Larvae were fed twice daily with rotifers that were separately cultured in rectangular cemented cisterns and circular FRP tanks. Fish were found to browse on the tank surface in the upper layer of water. A total no. of 40 fry (25-30 mm) could be found to alive in different tanks at their 36 days of age. Mortality was 100 % in 0.3 m depth tanks.

Transportation trials of hatched out larvae

In Trial 1, the 10-hrs old hilsa larvae were transported during September 2013 from Godakhali to RRC, CIFA, Kalyani covering 120 km in 5 hours duration. Larvae were transported in plastic vials, plastic jars, polythene packet and aluminium handi each with three replicates and at 100 nos./liter stocking density using tap water at 25^{0}C. Larval mortality was significantly higher in aluminium handi than other containers (Table 36). In Trial 2, the 1- hr old hilsa larvae were transported during February 2014 from Godakhali to Kalyani centre in closed air tight plastic packets (25 L capacity) each filled with 8 L of tap water and plastic jars (6.8 L capacity) each filled with 5.5 L of tap water. No mortality was observed.

Table 36. Mortality (%) of 10-hrs old larvae during transportation in different transporting systems

Transporting system	Water volume (L)	Larval mortality (%)
Plastic vial	0.3	5.55 ± 1.11a
Plastic jar	1.5	1.99 ± 0.38a
Polythene packet	6	2.44 ± 0.29a
Aluminium handi	30	39.93 ± 4.67b

Transportation trials of fry/fingerlings during April to August 2013

A total number of 45 exploratory transportation trials of hilsa fry/fingerlings were conducted at random from Hooghly river (region between Tribeni to Hooghly ghat) to RRC, CIFA, Kalyani centre covering a distance 9-16 km during April to August 2013 at 27.2-30.2 ^{0}C temperature of the transporting medium. The possible reasons for seed mortality were identified as in the following steps during transportation:

- The type of net used is for fish sampling is important for stress.
- Duration and on-boat acclimatization may be one of the stress factor.
- The other factors of stress may be the type of container, water management, vehicle used for transporting, rough condition of road etc.
- Post stocking management practices like water quality, water flow, transportation injury may be the stress factors.

Among different types of net used (Lift net, Pata jal and Ben jal) for wild seed collection from river Hooghly, the lift net was found better than others with regard to maximum period of survival during on boat acclimatization and fish gets very less injury and mucous loss. Exploratory trail on in-situ acclimatization within the river itself was also conducted in rectangular floating cages where 100% seed mortality was observed.

Transportation trials of fry/fingerlings

Wild caught hilsa fry/fingerlings were transported in aluminium handi at a distance of 14 km from collection site to RRC, CIFA, Kalyani office by motor van with 87.5 ± 2.45% survival (average of 34 days; 2-4 trials/day) during December 2013 –March 2014 at 16-26.2 ^{0}C temperature of the transporting medium. Handi was kept over an 8 inch thick sponge pad to reduce the jerking during transportation. The duration of transportation was 30-45 minutes.

Acclimatization trial of fish seed before transportation

Two trials on the acclimatization of hilsa seed were conducted in Bansberia area at Swapanpuri ghat near the collection ground in different type of container viz., FRP tank, plastic tub and aluminium handi each with three replicates. Fish were stocked @ 1 no/ 12 liter of river water and the experiment was conducted for 5 hours without aeration. The size of the fish in Trial-1 and Trial-2 was 76.1 ± 1.62 mm/3.62 ± 0.24 g and 90.19 ± 2.39 mm/7.36 ± 0.65 g, respectively. Fish survival was significantly higher in FRP tank than others in both the trials (Table 37).

Table 37. Fish survival (%) in different type of container during acclimatization

Container	Trial-1 (February 2014)	Trial-2 (March 2014)
FRP tank	80 ± 11.54^a	66.67 ± 11.54^a
Plastic tub	20 ± 11.54^b	0^b
Aluminium handi	20 ± 11.54^b	0^b

Acclimatization trial of fish seed after transportation

The transported reverine hilsa seed at Kalyani Centre were acclimatized in circular cemented hatchery (dia. 4 m, h. 1 m, water holding capacity 12,600 L, water flow rate 0.09 m/sec. and water exchange rate 0.6 L/sec.) prior to stocking in the pond. Fish mortality occurred within 24 hours and after that there were no mortality. Fish survival during acclimatization in hatchery was 21-80% (average of 12 trials). Before stocking in pond, fish were acclimatized in hatchery initially for 11 days which could be gradually reduced to 10, 9, 3 and 2 days in subsequent trials and found that only 2 days acclimatization is sufficient before stocking them in pond.

Nursery rearing of Hilsa

Trial 1 : The wild caught Hilsa seed (55.63 ± 0.6 mm / 1.61 ± 0.06 g) were stocked @ 4600 nos/ha in earthen nursery pond (0.01 ha area, 1.2 m depth). Fishes were provided daily with mixed planktons that were collected from other ponds. During three months culture period, fish grew to 140 ± 1.58 mm/36.0 ± 1.0 g with 43.5% survival. Growth performance of hilsa is given in Fig. 47.

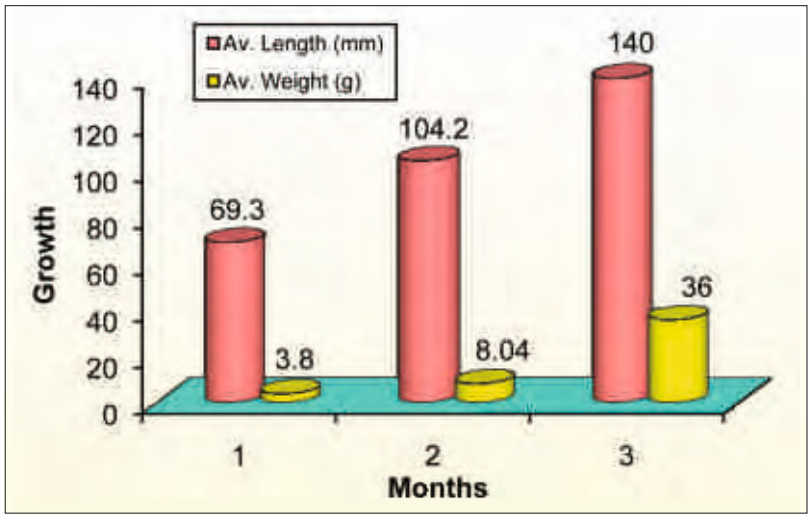


Fig. 47. Average length and weight of hilsa cultured in 0.01 ha pond for 3 months

Trial 2: During end of Dec. 13 – mid. March 14, hilsa seed (65.72 ± 2.18 mm/ 2.4 ± 0.23 g) @ 50,000/ha has been stocked in nursery pond (0.01ha area, 1.2 m depth). The stocked fish are being regularly fed with planktons collected from plankton culture unit. Fish attained the size 106.2 ± 14.1 mm/9.34 ± 1.21 g in nursery pond as on 21.3.14. Culture is in progress.

Grow out culture of hilsa

Trial 1: Nursery reared hilsa fingerling (140 ± 1.58 mm/36.0 ± 1.0 g) were restocked in concrete lining grow out pond (0.1 ha area, 1.9 m depth) in the month of August 2013 @ 200 nos/ha. Fishes were provided daily with planktons (rotifer, cyclops, diaptomus, diaphanosoma, nauplii, diatoms, chlorella and spirogyra) that are collected from other ponds. Fish mortality occurred in the months of November 2013, December 2013, January 2014 and April 2014. The survived fish attained the size 250 mm/163 g with a survival of 25 % in 7.5 months culture period.

Trial 2: During end of December 2013 – mid. March 14, hilsa seed (81.11 ± 1.88 mm/ 5.4 ± 0.4 g) has been stocked @ 20,000/ha in grow out pond (0.1 ha area, 1.9 m depth). The stocked fish are being regularly fed with planktons collected from plankton culture unit. Fish attained the size 140.6 ± 13.03 mm / 33.4 ± 6.49 g in grow out pond as on 21.3.14. Culture is in progress.

H. Regional Research Centre, Rahara

Project Title : Evaluation of production performance and quality assessment of carp utilizing certain potential wastes

Project Code : I-81

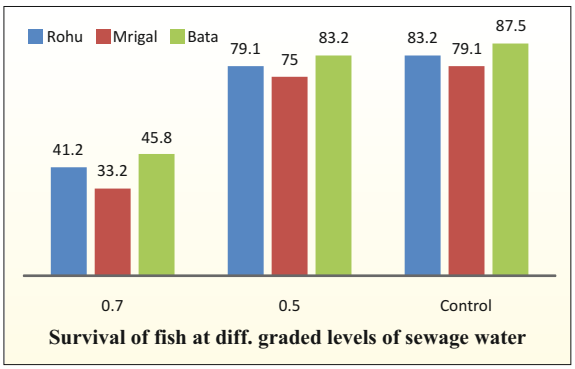
Funding Agency : Institute-based

Duration : April 2012 - March 2015

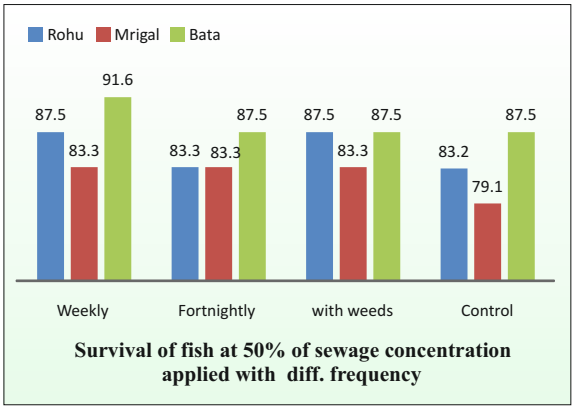
Project Personnel : R. N. Mandal (PI), P. P. Chakrabarty, B. N. Paul, B. K. Pandey and J. K. Ghosh

Determination of rate and frequency of waste water required for fish culture

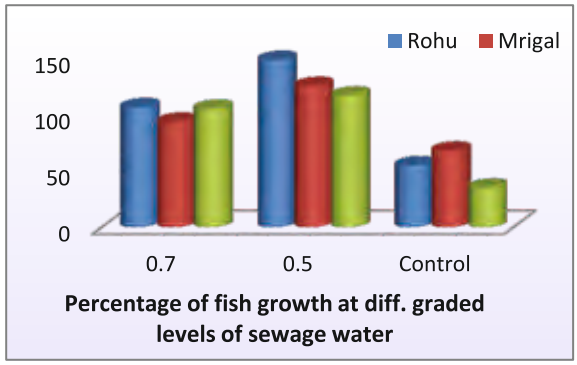
Different graded levels of waste effluent (sewage water) which was primarily treated through treatment plant were used for experiment to determine its rate suitable for fish rearing. It was observed that fish across the species (Rohu, Mrigal and Bata) reared at 50% waste (primary treated sewage) concentration showed better survival than those reared in 70% concentration. The study exhibited that 50% concentration of waste (sewage) effluent might be applied for rearing fish subject to frequent analyses of waste effluent since characteristic of waste effluent is found ever changing (Figs. 48-51).



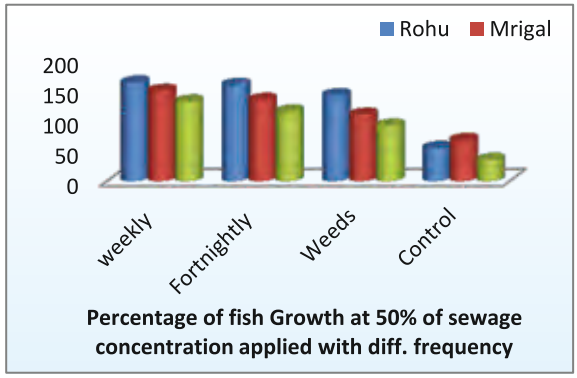
Survival of fish at diff. graded levels of sewage water



Survival of fish at 50% of sewage concentration applied with diff. frequency



Percentage of fish growth at diff. graded levels of sewage water



Percentage of fish Growth at 50% of sewage concentration applied with diff. frequency

Considering 50% concentration of waste effluent (primary treated sewage) suitable for fish rearing, this concentration was used for fish culture with its weekly and fortnightly application in two different experiments to standardize the frequency level suitable for fish survival and growth. The amounts of 8.5 liter and 17.0 liter of waste effluent were applied @ 2.5% weekly and @ 5.0% fortnightly considering 350 liter of waste effluent as the base amount used initially. It was observed that survival record of fish across the species was found almost similar in different frequency of waste applied. When fish growth was studied, it was observed that fish across the species reared at 50% sewage concentration showed better growth than those reared in 70% concentration and control condition. Fish reared at 50% sewage concentration with weekly sewage application exhibited better growth than those reared with fortnightly sewage application. However, significant difference ($p > 0.05$) was not found in the growth of fish reared in two different frequency.

Field trial using agro-industrial wastes and municipal sewage on fish growth and related ecological parameters

The ghee residue a dairy plant waste was collected from Icchamati Milk Union Chilling Plant, Berachampa, North 24 Paraganas, West Bengal. Proximate Composition: Protein content: 22.00 (%), Lipid content: 12 (%), Ash content: 4.00 (%). The fatty acid profile of Ghee Residue was analyzed and saturated fatty acid (SFA) content was 86.54%.

Myristic acid and Palmitic acid content was maximum among SFA. Monounsaturated fatty acid (MUFA) content was 11.67% and Poly unsaturated fatty acid (PUFA) content was 1.78% (Fig. 52).

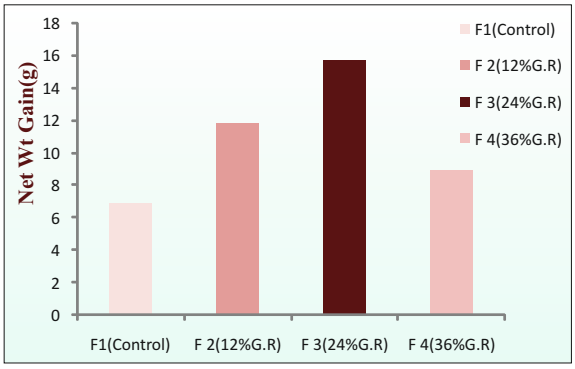


Fig. 52. Net weight gain of rohu juveniles on feeding of ghee residue

The Ghee Residue (G.R.) was used as one of the ingredient in rohu feed where 0, 12, 24 and 36 (%) level of G.R. was incorporated along with other ingredients. The growth trial was conducted for 90 days with *Labeo rohita* juveniles (av. wt. 39.70 g) to evaluated different levels of ghee residue incorporation in carp diet under laboratory condition. The net weight gain was significantly higher in rohu juveniles fed with 24% of G.R. The proximate compositions of the carcass tissue revealed that moisture, protein and ash percentage did not vary among the feed treatments. However, carcass lipid increased with incorporation of ghee residue in feed treatments. The fatty acid profile of rohu juveniles fed with ghee residue was also analyzed and data reflected that SFA content was higher in ghee residue treated feed. MUFA and PUFA content were higher in control feed when compared to other groups. Ghee residue can be incorporated in the diet of rohu juveniles' upto 24% along with other feed ingredients under laboratory condition.

Ghee residue experiment was also conducted under field condition for 96 days; in which rohu fingerlings grew from10.5g to 91.0 g. The feed was formulated with rice bran, soyabean meal, mustard oil cake and vitamin mineral mixture in control feed and treated feed was incorporated with 20% of ghee residue. The carcass proximate composition and fatty acid profile was also analyzed. The EPA and DHA content of rohu fingerling ranged from 0.46 to 0.54 (%) and 0.18 to 0.99 (%) respectively. Under field condition Ghee Residue can be incorporated upto 20% along with other feed ingredients.

Analysis of possible toxicants/contaminants including certain heavy metals, pesticides, etc. in fish tissues as well as wastewater source

Five different fish species with respective weight range such as catla (0.5-1.5 kg), rohu (0.5-1.25 kg), mrigal (0.5-1.25 kg), Bata (0.04-0.12 kg) and Reba bata (0.04-0.12 kg) collected from both raw waste fed water body, East Kolkara Wetland and primary treated waste water fed ponds, RRC, CIFA, Rahara farm were analyzed for detecting possible pesticide residues in fish muscles. Eight different pesticides residues such as Alpha-Endosulphon, Beta-Endosulphon, Endosulphon sulfate, Chlorpyrifos, Monocrotophos, Malathion, Mancozeb and Carbaryl were considered for analyses, which are commonly used in agriculture practice. No residues of above mentioned pesticides were detected at the limit of 0.01mg/kg of fish sample. In other effort with the help of Scientists from CIFRI, Barrackpore, pesticide residue was analyzed in tissue, liver and gill of catla reared in waste (sewage) fed ponds in RRC, CIFA farm. No organochlorines pesticide residues were detected up to 1.0 ppb level among the organs, when 6 numbers of organochlorines pesticides viz., Hexachlorocyclo hexane (HCH), DDT, Endosulfan, Dicofol, Heptachlor and Aldrin were assayed

Only catla species which was reared in wasted fed pond was analyzed for detection of possible heavy metals such as Cu, Mn, Zn and Fe from gill and muscle. The metals were recorded in the range of following amounts (ppb): Cu, 0.03-0.05 (gill), 0.06-0.07 (muscle); Mn, 0.60-0.61 (gill), 0.21-0.23(muscle); Zn, 5.20-5.37(gill), 0.40-0.50 (muscle); and Fe, 3.83-4.07(gill), 1.0-1.49 (muscle).

Qualitative and quantitative assessment of nutrients, BOD5, pH, conductance hardness and alkalinity of waste effluent and sewage used as experimental media

Certain physico-chemical parameters were done as usual practice while conducting the experiment. BOD5 was recorded in the range of 50-60 ppm and 20-25ppm in the 70% and 50% concentration of waste water used for experiment. The respective concentration of waste water with optimal levels of BOD were standardized and monitored to maintain the rate and frequency of waste water for the purpose of its effective utility in fish rearing. This experiment may be useful for utilization of waste water in the purpose of water conservation and abating water pollution through its wise use.

I. Regional Research Centre, Bangalore

Project Title	:	Species Diversification in Aquaculture: Development of Sustainable Practices for Introduction of Peninsular Fishes in Culture Systems
Sub-project Title	:	Brood stock development, breeding and larval rearing of *Puntius carnaticus*, and *Puntius pulchellus*
Project Code	:	I-86(a)
Funding Agency	:	Institute-based
Duration	:	April 2013 – March 2016
Project Personnel	:	N. Sridhar (PI)

Two trips were made to Cauvery and Shimshabasins near Malavali to collect juveniles of *P. carnaticus*. About 90 juvenile (15 mm) and fingerlings (8.5 mm) of *P. carnaticus* and 15 adult fishes of *P. fasciatus* were brought back to the Center's ponds and acclimatized. After a period of 30 days of constant monitoring and prophylactic treatment in a cement cistern of 24 m^3 the wild fingerlings were transferred to 0.1ha earthen pond and their growth monitored periodically.

The farm bred *P. carnaticus* spawn were monitored for their growth in aquarium for a period of 90 days from 6 day after hatching (DAH). The spawn grew at a growth rate of 0.3 mm/day in length and 3.56mg/day in weight in a period of 79 days. The spawn transferred to a cement cistern at 6DAH at a stocking density of 50/m3 recorded a growth of 45mm in length and 0.955 g in weight in a period of 120days.The growth rate of 46 DAH fry, transferred to a cement cistern (stocking density of 2000/24 m3) was recorded as 0.24 mm/day in length and 19.30 mg/day in weight in a period of 203 days. The growth rate of fingerlings in a 0.1ha earthen pond was 0.66 mm/day in length and 603 mg/day in weight in a period of 233 days. The fingerlings collected from rivers and cultured in earthen pond of 0.1 ha grew at a growth rate of 0.535 mm/day in length and 502 mg/day in weight in a period of 270 days (Figs. 53&54). Thus the growth rate of farm bred *P. carnaticus* fingerlings is comparable to that of collected from wild.

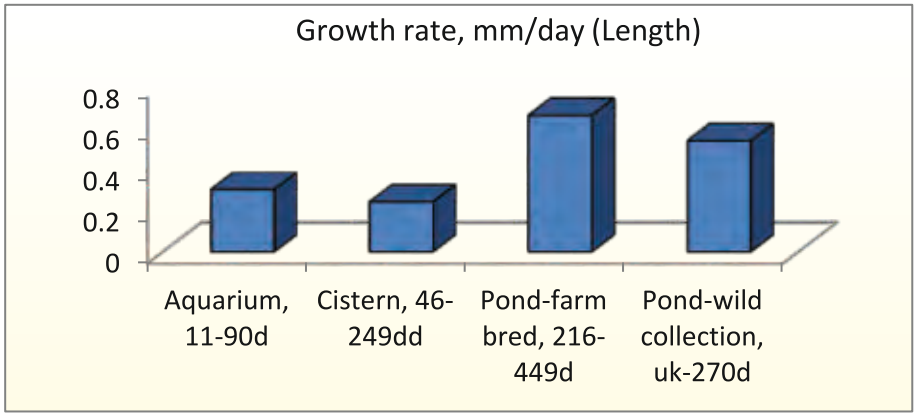


Fig. 53.Comparison of growth rates of *Puntius carnaticus* at various stages and culture systems

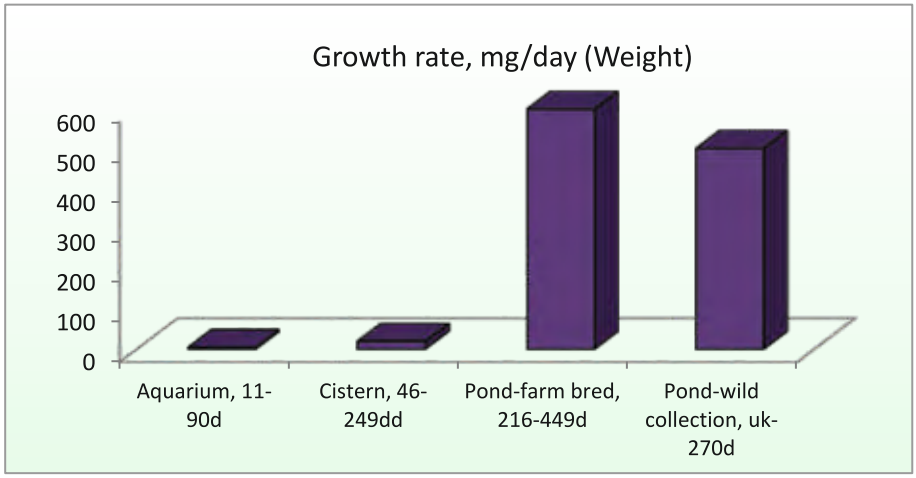


Fig. 54.Comparison of growth rates of *Puntius carnaticus* at various stages and culture systems

Sub-project Title : Enhancement of maturation through feeding and hormonal inputs in the peninsular carp *Puntius pulchellus*

Project Code : I-86(b)

Funding Agency : Institute-based

Duration : April 2013 – March 2016

Project Personnel : B. Gangadhar (PI)

In order to enhance the maturation of the Peninsular Carp under culture conditions, adults of *P. pulchellus* were stocked in ponds lined with 150 GSM HDPE tarpaulin. *P. pulchellus* adults (av.wt 1.23 kg) were distributed to four tanks of 100 m^2 @ 4 and one of 64 m^2 @ 3/pond. A total of five feeds were formulated and their proximate composition determined (Table 38). Feed 1 was the control feed and feeds 2-5 were formulated based on the results obtained from the in-vitro hydrolysis studies of interaction of protein feed ingredients with carbohydrate sources. Feed 5 was prepared with Azolla in addition to other protein sources. Fish in the five tanks were fed one of the above diets at 3.5% of the body weight. Fish growth was recorded once in 2 months. The behavioral pattern/ courtship/ external dimorphism/Expression of milt with respect to the stocked male and female fishes in each pond were monitored regularly. The fishes fed Feed 1 (GNC and rice bran, 1:1), developed rounded belly as observed in the earlier years as due to accumulation of visceral fat. Males did not show any external dimorphism. In other ponds, where a mixture of silkworm pupae, soybean meal, fishmeal and azolla were used, the males responded with the characteristic formation of pink tubercles in the mouth but ready expression of milt was observed in the fish fed with feed containing higher percentage of soybean meal during the months of February, 2014.

Table 38. Proximate composition (%) of feeds

	Moisture	Crude protein	Fat	Ash	Fibre	NFE	Gross energy (kJ/g)
Feed 1	6.40 ± 0.23	28.20 ± 0.67	10.90 ± 0.17	8.42 ± 0.01	8.99 ± 0.01	37.08	16.99
Feed 2	5.92 ± 0.09	33.80 ± 1.51	9.78 ± 0.64	9.98 ± 0.02	8.55 ± 0.20	31.97	16.94
Feed 3	6.29 ± 0.19	34.19 ± 0.14	5.71 ± 0.02	7.82 ± 0.04	6.03 ± 0.22	39.98	16.82
Feed 4	7.22 ± 0.01	30.89 ± 0.53	4.40 ± 0.11	6.80 ± 0.07	6.92 ± 0.07	43.77	16.22
Feed 5	2.10 ± 0.11	31.91 ± 0.17	7.49 ± 0.70	18.35 ± 0.01	7.19 ± 0.36	34.86	16.12

Sub-project Title : Value added products from medium and small indigenous fish species

Project Code : I-86(c)

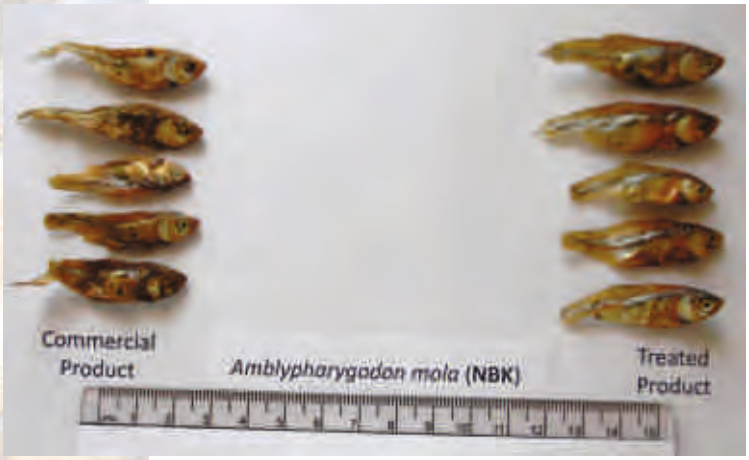
Funding Agency : Institute-based

Duration : April 2013 – March 2016

Project Personnel : M. Raghunath (PI)

Among 3 different starch sources evaluated for fish cracker production, from minor carps, corn starch followed by low amylose rice flour were better in terms of length and diameter expansion upon deep fat frying. High amylose rice was least suitable. Length expansion of crackers was more affected by higher level of fish meat incorporation than diameter expansion.

The high total ash (TA) and acid insoluble ash (AIS) contents of 5 commercial varieties of dried fish produced from alvi net catches could be effectively reduced by a simple method consisting of soaking and agitated washing followed by redrying to about 6% moisture. The TA was brought down from 16.8 to 14.8, while AIS was reduced from 3.2 to 1.2%, with mean product yield of 92%. Physical appearance of all dry fish samples was also much improved as a result of the treatment.



Sub-project Title : Studies on Argulus infection pattern in peninsular carps subsequent up on their introduction to culture systems with an aim on development of prophylactic and control measures

Project Code : I-86(d)

Funding Agency : Institute-based

Duration : April 2013 – March 2016

Project Personnel : Hemaprasanth (PI)

Evaluation of susceptibility of *Labeo fimbriatus* fry, fingerlings and adults to Argulus

Evaluation of susceptibility of *L. fimbriatus* fry, fingerlings and adults to Argulus revealed that adult fimbriatus tolerates challenge with up to 1800 metanuaplii/ fish and an infective dose of 2000 per fish is lethal. However, an infective dose of 400/fish and above is highly pathogenic and results in 100% mortality in fimbriatus fingerlings. An infective dose of 200/ fish was found ideal for maintaining experimental infection in fingerlings. Studies on Argulus Infection pattern in fimbriatus fry and fingerlings cultured together showed the fry to be the most susceptible and get affected by the parasite first. After the death of all the fry in the cohabitation trial, the parasite establishes and results in the death of the fingerlings.

Effect of exposure to infective stages of Argulus on other peninsular fishes, viz; *Puntius kolus, Puntius carnaticus* and *Puntius pulchellus* was also evaluated. An infective dose of 600 metanauplii/fish and above was lethal for *Puntius kolus* subadults, whereas the lethal infective dose for *Puntius pulchellus* subadults was 800/fish. *Puntius carnaticus* fingerlings are relatively resistant to Argulus, tolerating challenge with doses up to 800 metanaupli per fish. However, infective doses of 1200 and above resulted in fish mortality.

Experimental studies revealed that it is possible to develop some degree of protection against reinfection in *P. carnaticus* by exposing the fingerlings to a sub lethal dose of Argulus metanauplii, but this protection was short lived, remaining only up to 7 days post initial immunizing dose. Protection was not evident 15 days after the initial challenge and when exposed to the lethal dose resulted in 100% host mortality.

It is possible to attenuate the infective stages of Argulus by exposing them to UV radiation, as UV exposed metanauplii either did not develop or resulted in a very mild infection with nil pathology in fimbriatus fingerlings. Attempts to attenuate the metanauplii by exposing to chemicals (formaldehyde) and temperature variations did not give very positive results, except in case of exposure at 4°C for 15 min.

Project Title	: Periphyton enhancement – a sustainable technology for efficient nutrient utilisation in seed rearing and grow-out culture of carps with special reference to the peninsular carp *Labeo fimbriatus*
Project Code	: E-79
Funding Agency	: DBT
Duration	: 19 September, 2012 – 18 August, 2015
Project Personnel	: Gangadhar Barlaya (PI) and N. Sridhar

Performance of *Labeo fimbriatus* in nursery rearing under periphyton enhanced conditions

Nursery rearing of *L. fimbriatus* was undertaken in outdoor cement tanks with soil base, where periphyton growth was enhanced by providing sugarcane bagasse as substrate. The growth parameters in terms of final weight of fish, weight gain and biomass were the highest under Substrate + Feed treatment. The growth of fish under substrate only treatment was comparable with that of the Control. No difference was observed with respect to final length and survival of fish between treatments. The activity of digestive enzymes corroborated the growth pattern. Enhancing periphyton growth can be an alternate for artificial feeding in nursery rearing of *L. fimbriatus*.

Influence of periphyton-based culture systems on the performance of fringe-lipped carp, *Labeo fimbriatus* in fry to fingerling rearing

A 90-day experiment was conducted in outdoor circular cement tanks to evaluate growth and survival of *Labeo fimbriatus* fry when provided with sugarcane bagasse as a periphyton substrate. In all there were six treatments viz. feed, substrate, substrate + feed, substrate in tank bottom + feed and substrate + feed + double stocking density. Sugarcane bagasse was hung vertically at 2t/ha, except in Substrate in tank bottom + Feed, where it was applied at the tank bottom. *L. fimbriatus* fry were stocked @ 30/m3, excepting the last treatment which received 60 fry/m3. No variation ($P>0.05$) was observed between the different treatments with respect to the water quality parameters - pH, temperature, dissolved oxygen, total alkalinity, and Secchi disc visibility. No difference in fingerling length was recorded, except for Substrate in tank bottom + Feed treatment, where it was higher ($P< 0.05$). Weight, SGR and percent weight gain were similar ($P>0.05$) in Feed and Substrate treatments; provision of substrate in the water column or at the tank bottom in addition to feed, affected these parameters positively. Survival was lower when the substrate was provided at the tank bottom. The results indicate that stocking density can be doubled in tanks provided with substrates, without affecting seed size and survival.

Estimation of periphyton digestibility by *Labeo fimbriatus*

An experiment was carried out to study and compare dry matter and protein digestibility of periphyton grown on sugarcane bagasse bundles and a pelleted feed by *Labeo fimbriatus*. Advanced fingerlings maintained in glass aquaria were allowed to feed on fresh periphyton or pelleted feed (20 g crude protein 100 g-1) daily morning and the fecal matter collected following standard procedure. Fecal matter collected over the period of 60 days was dried and pooled for proximate composition analyses. Acid insoluble ash was used as the reference marker for digestibility estimation. Activity of total protease, trypsin, chymotrypsin, carboxypeptidase-A and B, amylase, lipase and cellulase in the gut of fish was estimated at the end of the feeding trial. Periphyton and feed showed similar ($P>0.05$) protein digestibility (92.29 and 89.21% respectively), while total dry matter digestibility was higher ($P<0.05$) with the former (85.44 and 75.16%, respectively). Among the proteases estimated, the activity of total protease and carboxypeptidase B was higher ($P<0.05$) in fish fed periphyton, whereas the activity of others showed no difference between periphyton and feed ($P>0.05$). The activity of carbohydrases and lipase was higher in fish fed feed. The study reveals that *L. fimbriatus* can utilize periphyton efficiently.

Comparative evaluation of digestive enzyme activity in periphyton and plankton

Periphyton grown on sugarcane bundles was analysed for major digestive enzymes in order to determine their possible contribution of exogenous digestive enzymes to grazing fish. Fresh plankton biomass was collected by filtering water from the same tank using 50 μm silk cloth. The activity of major digestive enzymes - total protease, trypsin, chymotrypsin, carboxypeptidases, amylase, lipase and cellulase activity were estimated following standard procedures for the extracts from periphyton and plankton. The activity of major digestive enzymes was higher in plankton compared to periphyton (Fig. 56).

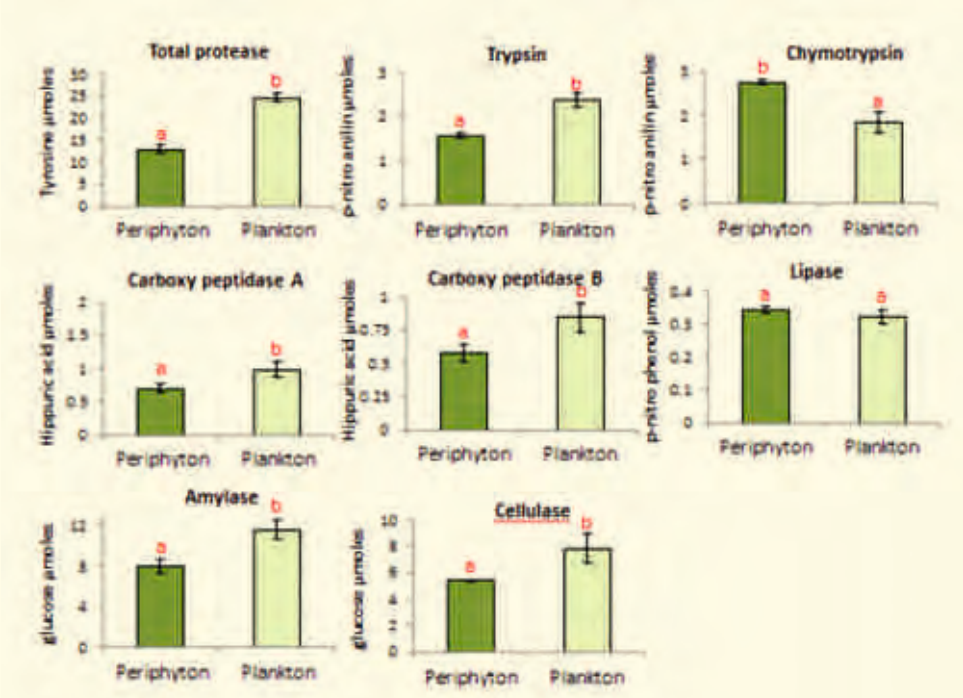


Fig. 56. Activity of digestive enzymes in periphyton and plankton

J. Regional Research Centre, Vijayawada

Project Title	:	Development of better management practices for striped catfish *Pangasianodon hypothalamus* farming in India
Project Code	:	E-68
Funding Agency	:	NFDB
Duration	:	February, 2011 – January, 2016
Project Personnel	:	B. S. Giri (PI) and P. V. Rangacharyulu

Brood stock of striped catfish, pangas average weight 3 to 4 kg are being maintained in the farm ponds. Fish are fed with commercial floating feed having 28% protein. Portable carp hatchery was made ready with installation of with water circulation, Aeration and sprinkle facility. Gravid females were selected along with matured males at 4:1 ratio (F:M). The fishes were injected with pituitary hormone and stripped egg and milt was mixed well in plastic trays. This egg along with milt was transferred to portable hatchery for fertilization and spawn appeared in 18-24 hr. About 20 lakh spawn produced and was stocked in cement tanks and fed with natural feed and skimmed milk powder. Fry obtained stocked in ponds for fingerling rearing.

Dissemination of disease resistant rohu in Andhra Pradesh

Disease resistant rohu spawn were stocked in centre ponds and also in farmers ponds. Tagging was done for produced fry. Approximately 6000 fingerlings obtained in the center and 7000 in farmer ponds. Inundation of experimental facility was done due to heavy flood and phailin rain which leads to loss of stock. About 1500 numbers were recovered and supplied (avg wt 125 g) to one farmer in Guntur District in December 2013. The fishes have grown to 345 g and stocks were out of any disease.

Establishment of *M. rosenbergii* brood bank at College of Fisheries Farm, Nellore

To establish a viable brood bank at Nellore Post larvae of Freshwater prawn were supplied to College of Fisheries, Nellore and were stocked in ponds of size in the month of June 2013. Monthly sampling was carried out to observe the growth and health status of the animal. To run a hatchery it requires large quantity of brooders, college farm cannot supply such large numbers of berried females hence one 2 acre pond of a farmer was selected in Kovvuru and is stocked with PL for brood stock raising in the month of August, 2013. Technical guidance was provided to College of Fisheries Nellore to culture prawn up to viable brood stock for seed production. The prawns are active and healthy. Average weight recorded on 19/3/14 was 44.5 g out of 400 number sampled. In college pond average weight recorded was 44.3 g out of 400 numbers collected. Berried females observed in both places.

Ornamental fish culture and breeding unit

A small ornamental fish culture unit is established. The unit consists of both live bearers and egg layers. Live bearers such as guppies, mollies of different colour, platy and egg layers like gold fish angel, gourami and koi carps are being bred.

K. Regional Research Centre, Gujarat

Project Title	:	Exploring potential of freshwater aquaculture technology intervention in Gujarat
Project Code	:	I-79
Funding Agency	:	Institute-based
Duration	:	April 2012 – March 2014
Project Personnel	:	C. K. Mishra (PI), A. K. Sahu (upto 30.9.2013) and Subhas Sarkar

Two numbers of Demonstrations on carp seed rearing from fry to fingerlings was undertaken in Anand and Kheda districts of Gujarat. One progressive fish farmer from each district was provided with complete technical support through demonstration on carp fingerling production. After pre-stocking preparation of rearing ponds, the carp fry of average size of 25-35 mm were stocked @ 3 lakhs/ha in the farm ponds of each farmer. The carp fry were reared for three months from August-October, 2013 with appropriate post stocking management practices including manuring, fertilization and supplementary feeding. Growth and survival of fingerlings at the end of carp seed rearing demonstration was recorded. Carp fingerlings of average size of 71-99 mm were recorded after three months of rearing.

Considering the adverse effect of very high water hardness (> 400 ppm) of central Gujarat, a study was carried out on effect of water hardness on egg hatchability and larval viability of rohu. Fertilized eggs were randomly assigned to six treatments of total water hardness (30, 75, 150, 250, 350 and 450 mg/l $CaCO_3$) and data on hatching %, larval survival and development were recorded (Table 39). Based on present study, a total water hardness of 30-150 mg/l $CaCO_3$ is, therefore recommended for efficient hatching, high viability and maximum larval development of rohu.

Table 39. Egg hatching (%) and post hatch survival to end of yolk-sac period (%), larval development of *Labeo rohita* at different levels of total water hardness (Mean ± SD).

Total Hardness (mg/l $CaCO_3$)	Initial Number of Eggs	Hatching Rate (%)	Post Hatch Survival (%)	Mean Total Lengths (mm)
30	208 ± 6.1	83.9a ± 3.3	72.2a ± 3.9	6.77a ± 0.27
75	209 ± 4.5	84.6a ± 3.7	73.6a ± 3.6	6.85a ± 0.28
150	203 ± 8.1	88.5a ± 5.0	76.8a ± 3.9	6.66a ± 0.28
250	199 ± 5.1	64.6b ± 5.8	48.9b ± 6.0	5.93b ± 0.31
350	205 ± 4.2	42.3c ± 6.3	26.3c ± 7.4	5.83b ± 0.16
450	202 ± 3.0	18.2d ± 3.1	6.8d ± 1.3	5.58c ± 0.26

*Mean values within each column which do not have the same superscript letter are significantly different ($p < 0.05$)

TECHNOLOGY TRANSFER, WORKSHOPS, TRAININGS AND FARMERS MEETS

Training programmes of the Institute

The Institute offered several short-term training courses during the year for capacity-building of field-level functionaries, who in turn would transmit advanced technical know-how to the end-users. Courses were demand-driven and the delivery was based on the principle of 'learning by doing' with adequate background in theory. Besides, extension officers in the state department of fisheries, college/university teachers, students, entrepreneurs and NGO officials were also benefited from the courses. Training programmes conducted this year are presented in Table 40.

Table 40. Training programmes conducted during 2013-14

Sl. No.	Title	Venue	Duration	No. of Participants
1.	Induced breeding of indigenous magur	RRC, Anand	27-29 May, 2013	26
2.	Installation of carp hatchery	Guwahati, Assam	29-30 May, 2013	32
3.	Molecular biology techniques	CIFA, HQ	24-30 June, 2013	24
4.	Attachment training of three students from Fish Genetics and Biotechnology Division of CIFE, Mumbai	CIFA, HQ	25 June - 3 August, 2013	3
5.	Advances in seed production with special reference to FRP carp and magur hatchery technologies for North-eastern states of India	CIFA, HQ	8-12 July, 2013	69
6.	Culture and seed production of carps with special emphasis on SIFs	RRC, Rahara	8-13 July, 2013	7
7.	Advances in freshwater induced breeding of IMC and their culture technology	RRC, Rahara	9-14 July, 2013	36
8.	Skill development in freshwater aquaculture in Hindi Language	CIFA, HQ	15-19 July, 2013	21
9.	Skill development in freshwater aquaculture	CIFA, HQ	7-8 August ,2013	50
10.	Recent advances in freshwater aquaculture	CIFA, HQ	19-26 August, 2013	10
11.	Winter School on Advances in molecular and serological tools in fish disease diagnosis	CIFA, HQ	9-29 November, 2013	23
12.	*Unnata Mithajal Matsya Palan* (in Hindi) (Farmers from Patna, Bihar)	CIFA, HQ	12-16 December, 2013	30

13.	Mithajal Matsya Palan Me Unnat Pradyogiki (in Hindi) (Farmers from Aurangabad, Bihar)	CIFA, HQ	20-24 December, 2013	30
14.	Mithajal Matsya Palan Me Kaushal Vikash (in Hindi) for the farmers of Gaya District, Bihar	CIFA, HQ	21-25 January, 2014	30
15.	Mithajal Krishi Ke Nae Aayam (in Hindi) for the Fisheries Officers of Chhattisgarh	CIFA, HQ	28-30 January, 2014	17
16.	Training Programme for Entrepreneurs on fish feed production technology	CIFA, HQ	10-12 February, 2014	8
17.	Mithajal Matsya Palan Me paddhatiyan (in Hindi) for the farmers of Lakhisarai district, Bihar	CIFA, HQ	14-18 February, 2014	30
18.	The diversification and integration possibilities in inland aquaculture practice (under Fisheries-ATMA 2012-Interstate Training to Aquafarmers from Kerala conducted jointly by the Regional Centres of CIFA and CIFRI, Bangalore	RRC, Bangalore	24 February – 1 March, 2014	21
19.	Integrated Farming System in collaboration with PDFSRs AICRP centre BCKV, Mohanpur	Bali, Sundarban	23-24 March, 2014	100
20.	Integrated Fish cum duck farming	Bali, Sundarban	29 March, 2014	30
	Total			**597**

Agricultural Technology Information Centre (ATIC)

The Agricultural Technology Information Centre as a sub-component of the "Innovations in Technology Dissemination" under National Agricultural Technology Project (NATP) has been established at the Institute to provide technology products, services and information through a single window system to farmers and entrepreneurs. During this year, 7616 farmers visited ATIC and CIFA facilities. This centre has generated revenue of Rs. 12,82,761 from sale of fish & milk and Rs. 5,53,671 from sale of farm produce. Total 1621 number of farmers were benifited from technology services of ATIC. A large number of pamphlets / booklets were also distributed to the visitors.

HELPLINE services has been initiated wherein a group of experts attend to telephonic queries on fixed days of the week. Presently, the Helpline works during 3.30 p.m. to 5.00 p.m. on every Tuesday and Friday.

Field Days conducted by CIFA

A total of 27 Field Days were organized for the farmers of various districts of Odisha and other states covering many fish farmers including farm women. The field days include aquaculture farm visits, laboratories and other facilities. The farmers visit the learning stations which include hatchery and culture facilities for carps, air-breathing species and catfishes, freshwater prawns, ornamental fishes, flow through system, cage culture, feed mill, mechanized harvesting system, aquarium, Krishi Vigyan Kendra (KVK), Agricultural Technology Information Centre (ATIC) and others. They also engage in focused group interactions with the scientists who provide practical solutions to their operational difficulties. Many hands-on activities like fish breeding, soil and water quality management, fish health and nutrition etc. are also explained to them with the help of videos (Table 41).

Table 41. Field days conducted by CIFA during 2013-14

Sl. No.	Date	Topic	Participants		Total
			Male	Female	
1.	03.04.13	Women farmers from Erasama Block	0	21	21
2.	25.03.13	Fish farmer from Mungeli, Chattishgarh	7	-	7
3.	09.05.13	Fish farmers from Rayagada	28	-	28
4.	10.06.13	Students of Chhattisgarh Kamadhenu Vishwavidyalaya, College of Fisheries, Kawardha, C.G.	16	9	25
5.	19.07.13	KIIT Rural Management Students	26	5	31
6.	19.07.13	Technical Staff of Fisheries Staff Training Institute (FSTI), Tamil Nadu	12	-	12
7.	26.07.13	Trainees of Inland Fishery Training Institute, Imphal, Manipur	17	6	23
8.	29.07.13	Farmers, Ornamental Fish Culture sponsored ATMA, Balianta	4	13	17
9.	03.08.13	Students of Industrial Fish & Fishery, KBDAV College, Nirakarpur	13	14	27
10.	27.08.13	Training on participatory rural appraisal, for WMT Members, Sundergarh	22	4	26
11.	24.09.13	Farmers from Nadia district, West Bengal under ATMA Scheme	20	0	20
12.	13.11.13	Students of GBPU of Agrl. & Tech., Pantnagar, Uttarakhand	9	9	18
13.	29.11.13	Students from Bankura Christian College, Bankura-722101, West Bengal	9	16	25
14.	30.11.13	Farmers from Bad-Gogua Watershed, Bonai, Sundergarh	15	-	15
15.	09.01.14	Students from North-Eastern Hill University, Shillong, Meghalaya	5	23	28
16.	13.01.14	Farmers from Kabir Dham district of Chhattisgarh	15	-	15
17.	13.01.14	Farmers from Bemetara district of Chhattisgarh	10	-	10
18.	18.01.14	In-Service Trainees of Tripura Fisheries Training Institute Udaipur, Tripura	23	-	23
19.	21.01.14	Fish farmers of Durg, Chhattishgarh	14	-	14
20.	24.01.14	Council for Women Empowerment & Rural Development (CWERD), Bolagarh, Khurda	27	4	31
21.	21.01.14	B.F.Sc.& PGDIF students of College of Fisheries	5	14	19
22.	26.01.14	Farmers of SIP Laxmiposi, Baripada, Mayurbhanj	15	5	20
23.	16.02.14	Farmers of Surajpur, Chhattishgarh	10	-	10
24.	18.02.14	Fish Farmers from Andaman & Nicobar Island	8	-	8
25.	22.02.14	Farmers under Office of Joint Director of Fisheries, Diphu, Karbi Anglong, Assam	11	-	11
26.	25.02.14	Farmers from Mahasamund district of Chhattishgar	16	-	16
27.	26.02.14	Trainees of FTI, Balugaon	34	5	39

Exposure visits to CIFA

The Social Science Section organised 56 group visits comprising students, practicing farmers, farmwomen, extension workers and others. Duration of the visits were mostly one day, in few cases 2-3 days. Visitors were taken around the farm facilities, museum, selected laboratories and ATIC. Educational videos are screened for the visitors. For farmer groups question answer sessions were also organised for finding solutions to their queries.

Table 42. Details of the group visits organized

Sl. No.	Date	Particulars	No. of Visitors
1.	10.04.2013	Farmers from Jashpur, Chattishgarh	20
2.	10.04.2013	Farmers from Jashpur, Chattishgarh	60
3.	11.04.2013	Students from KISS, Bhubaneswar	47
4.	11.04.2013	Farmers from Bargarh, Odisha	17
5.	12.04.2013	Students from KISS, Bhubaneswar	41
6.	23.04.2013	Students from Burdhaman University, West Bengal	13
7.	27.04.2013	FTI, Balugaon	34
8.	29.04.2013	Farmers under ATMA, Bolangir	19
9.	24.06. 2013	Farmers from Sundergarh, Odisha	34
10.	06.07. 2013	Farmers from Saharapad, Keonjhar, Odisha	28
11.	06.07. 2013	Students from College of Fisheries, Raipur, Chattishgarh	23
12.	23.07. 2013	Farmers from Gondia, Dhenkanal, Odisha	30
13.	21.08. 2013	Farmers from Cuttack, Odisha	69
14.	27.08. 2013	WMT, Watershed, Sundergarh, Odisha	27
15.	03.09. 2013	Trainees from Dhenkanal, Odisha under Skill development training programme	25
16.	04.09. 2013	Trainees of Puri, Ganjam, FISHFED, BBSR	27
17.	17.09. 2013	Farmers from Sohela, Bargarh, Odisha	35
18.	20.09. 2013	Students from Hailakidi, Assam	17
19.	25.09. 2013	Trainees of FTI, Balugaon	30
20.	07.10. 2013	Farmers from Ambiki, Ersama, Jagatsinghpur	32
21.	09.10. 2013	Farmers from Rayagada, Gajapati, Odisha	25
22.	23.10. 2013	Farmers from Rayagada, Gajapati, Odisha	25
23.	20.11. 2013	Farmers from Pattamundai, Kendrapara, Odisha	23
24.	20.11. 2013	Farmers from Boudh, Odisha	25
25.	26.11. 2013	Farmers from Maneshwar, Sambalpur, Odisha	37
26.	27.11. 2013	Farmers from Kujanga, Jagatsinghpur, Odisha	31
27.	28.11. 2013	Students from UGB, Malda, West Bengal	12
28.	28.11. 2013	Trainees from Paradip, Jagatsinghpur, Odisha	25
29.	28.11. 2013	Trainees under FTI, Balugaon	44
30.	28.11. 2013	Students from R.Ruia College, Matunga(E), Mumbai-400019	17
31.	29.11. 2013	Farmers from Gop, Puri, Odisha	44

32.	03.12. 2013	Academy of Management & IT, Khurda	52
33.	07.12. 2013	Students of SSM, Naygarh, Odisha	145
34.	09.12. 2013	Students, College of Fisheries, Mangalore, Karnataka	40
35.	11.12. 2013	Farmers from Srikakulam, Andhra Pradesh	25
36.	13.12. 2013	Farmers from Kuchinda, Sambalpur, Odisha	30
37.	13.12. 2013	Students from Bagdevi Vidya Mandira, Balipatna, Khordha	20
38.	26.12. 2013	Students of Joti Das Govt. High School, Bada Rampur, Keonjhar (Hataditi Block)	45
39.	27.12. 2013	Trainees of FTI, Balugaon	54
40.	04.01. 2014	Farmers from Bargaon, Sundergarh	60
41.	08.01. 2014	Zoology Students from Salipur College, Salipur	49
42.	09.01. 2014	Farmers from Jaleswar, Balasore, Odisha	53
43.	13.01. 2014	Farmers of Kabir Dham and Bemetara, CG	27
44.	16.01. 2014	Students, Deptt. Of Zoology, Lucknow Univ. UP	37
45.	18.01. 2014	Tripura FTI, Tripura	25
46.	28.01. 2014	Students, College of Fisheries, OUAT	50
47.	12.02. 2014	Bharati Wash WMT(Social), Sundargarh	22
48.	14.02. 2014	Dist. Fisheries Officer, Dhenkanal, Odisha	22
49.	15.02. 2014	Students, Nimapara College, Nimapara, Puri	42
50.	17.02. 2014	Farmers, Rayagada, Odisha	28
51.	22.02. 2014	Farmers & Officers, Karbi Anglong, Assam	11
52.	25.02. 2014	Students, CIFNET, Ministry of Agriculture, Beach Road, Visakhapatnam, A. P.	27
53.	25.02. 2014	Soil conservation & Watershed Mission, Koraput	50
54.	28.02. 2014	BJEMS-II students & Durga Prasad Rath (TGT,Geo)	121
55.	11.03. 2014	FIAC, Remuna, Balasore, Odisha	19
56.	29.03. 2014	DFO, Dhenkanal, Odisha	25

Table 43. Field demonstrations by RRC, Rahara

Title	Duration	Participants
Aquaculture Field School (AFS) at Bodoland, Assam	24-26 November 2013	38
'Fish Culture and Breeding' on the topic 'Essential of Nutrition for fish culture' at RMSSSM, Belur Math	5-11 August, 2013	25

Table 44. Exposure visits to RRC, Rahara

Title	Period	Participants
Sewage fed aquaculture	02.07.2013	11
Sewage fed aquaculture	23.07.2013	17
Sewage fed aquaculture	11.09.2013	27
Sewage fed aquaculture	20.12.2013	30
Sewage fed aquaculture	23.12.2013	35
Sewage fed aquaculture	14.01.2014	35
Sewage fed aquaculture	15.01.2014	30

Table 45. Demonstration programme of field station, Kalyani

Sl No.	Training/ Exposure visit	Venue	Trainees from	Duration	Nos. of Participants
1.	Composite fish culture	Bali, Sunderban	Adibasipara, Hathkhola, Sunderban	12.3.2013	22
2.	Composite fish culture	Bali, Sunderban	Adibasipara, Hathkhola, Sunderban	04.06.2013	32
3.	Composite fish culture	Damdama, Birbhum	Damdama village	07.06.2013	102
4.	Composite fish culture	Bali, Sunderban	Adibasipara, Hathkhola, Sunderban	22.07.2013	29
5.	IMC breeding	Bali, Sunderban	Adibasipara, Hathkhola, Sunderban	25.07.2013	35
6 .	Integrated aquaculture along with breeding of Carp and some SIFS	CIFA, Kalyani	Adult Education Department, University of Kalyani	28-31.8.2013	6
7 .	fish culture integrated with agri-horti-livestock	CIFA, Kalyani	West Bengal Animal and Fishery University, Kolkata	10 – 11.9.2013	27
8.	Integrated duck cum fish culture	Bali island, Sundarban	Bali island, Sundarban	24-25.9.2013	40
9.	Fish Pickle Preparation by Using Low Cost Fish	Bali island	Adivasipara, Hatkhola, Bali Sundarban	1-2. 10. 2013	25
10.	Integrated Fish-cum agri- horti culture	Vivekananda University, Narendrapur Ramakrishna Mission	Integrated Rural Development, of Vivekananda University, Narendrapur Ramakrishna Mission	9. 10.2013	18
11.	Integrated fish culture	Field Station, Kalyani	Trainees from different districts of Bihar, trainees of CIFE Kolkata	24.10.2013.	27
12.	Fish culture integrated with agri-horti-livestock	Field Station, Kalyani	Trainees from dept. of Fisheries, Govt. of West Bengal	14.01.2014	30
13.	Fish culture integrated with agri-horti-livestock	Field Station, Kalyani	Trainees from dept. of Fisheries, Govt. of West Bengal	27.01.2014	35

Farmer-Scientist Interface Meeting at RRC, Bengaluru

An Aquaculture Farmer-Scientists Interface meeting was held on 24 October, 2013 at the Regional Research Centre of CIFA, Bengaluru. Dr. P. Jayasankar, Director, CIFA made a presentation on Freshwater aquaculture livelihood options and promising technologies. He also distributed peninsular carp *Labeo fimbriatus* fingerlings to the farmers on the occasion.

Training-cum-demonstration programmes at RRC, Anand

The RRC of CIFA, Anand, Gujarat organized a training-cum-demonstration programme on "Induced breeding of indigenous magur" during 27-29 May, 2013. The programme was conducted at Shree Jahukrupa Farm belonging to Shri Prasant Jaiswal, a progressive fish farmer of Tundel Village in Nadiad Taluka of Kheda District in Gujarat. The training programme was attended by 26 farmers

from different villages of Anand and Kheda Districts. The programme included the theoretical and practical aspects of induced breeding of magur, identification of indigenous magur, male and female differentiation, conditioning of matured brood stock, etc.

Training-cum-demonstration on Induced breeding of indigenous magur at Anand, Gujarat

RRC of CIFA, Anand, Gujarat organized an "Interactive workshop on ornamental fish culture" on 18 April, 2013. The workshop was inaugurated by Shri. R. Pathak, Deputy Commissioner of Fisheries, Gandhinagar and Dr. K.B. Kathiria, Director of Research and Dean PG studies, AAU, Anand. The topics discussed during the workshop were: present status and future prospects of ornamental fish culture in Gujarat, status of ornamental fish culture in India and the technical aspects of including breeding, culture and water quality management, etc. A video show on ornamental fish culture was also organized.

Interface meeting on carp seed rearing in Gujarat

CIFA through its Regional Research Centre at Anand had organised the One-day long Research-Extension-Farmers interface meeting on carp seed rearing to assess the status of its production and to mobilize the farmers and officials for production of good quality carp seed on 10 October 2013 at KVK, Devataj, Guajrat. More than fifty participants including research scientists from Anand Agricultural University, officials from Govt, of Gujarat Fisheries Department and progressive fish farmers attended the meeting. Dr. P. Jayasankar, Director, CIFA emphasized the need of quality seed for better fish production. CIFA being the leading organization in freshwater aquaculture has taken up the programme to sensitize the state government and other stakeholders on importance of producing and using quality fish seed in culture systems. Shri G. C. Vakani, Deputy Director of Fisheries, Govt. of Gujarat also opined the importance of quality seed production and their rearing to achieve higher production goal in future.

Activities of Krishi Vigyan Kendra (KVK), Kausalyaganga

The KVK is involved in the technology transfer for agriculture in Khurda district of Odisha through mechanisms like On Farm Trial (OFT), Frontline Line Demonstration (FLD) and Training. During 2013-14, KVK has conducted 17 OFTs, 22 FLDs, 86 trainings benefitting 159, 366 and 2050 beneficiaries, respectively.

On farm Trails (OFT)

During the year, few priority technologies were assessed viz., Leaf Colour Chart (LCC), intercropping of Onion in Pointed Gourd, Coriander Seed production (var Kalmi), White Pekin duck, CIFABROOD, Immunoboost-C and farm made feed. The yield of paddy with the use of Leaf Colour Chart (LCC) was observed to be 44. 8 q/ha against the farmers practice of 40.8 q/ha. The performance of White Pekin ducks under free range condition was assessed and the results indicated 160 eggs were produced compared to the local ducks with 110 eggs with a body weight of 4.5 and 2.3 kg respectively. The hybrid rice (var. 27P31) was found to be suitable for Kharif season under rainfed and irrigated conditions with a yield increase of 40.56% than local variety. The cooking quality and taste of the variety was found to be better and the grain size was medium. Growing of Coriander for leaf and seed purpose was found to be profitable. Selling of green leaf at initial stage and then seed was more remunerative than that of practice of Green leaf purpose only. Seed production was better in wider spacing (40x30 cm) as it resulted in more branches, less pest and disease incidence.

Front Line Demonstration (FLD)

The selected technologies through FLD were saline resistant paddy (var. Luna suvarna), hybrid rice, tissue culture banana, chabro broiler and stocking of IMC in community ponds. The FLD on hybrid (var Ajaya) resulted with 48.7% higher yield than local variety. The varietal demonstration of green gram (var. Durga) yielded 6.49 q/ha compared to the local variety with 5.02 q/ha. The demonstration of tissue culture banana saplings with nutrient management @FY 25:30:100 gm/plant/month had a fruit weight of 29.9 g compared to the local banana variety of 24.4 g with an yield increase to 1098 q/ha compared to local variety with 685.8 q/ha. The demonstration on the use of CIFAX @ 1 litre/ha indicated that there was a reduction in occurrence of ulcer diseases.

Table 46. OFT and FLD conducted by KVK

Quantifiable Achievement	Number	Beneficiaries
On Farm Testing (OFT)		
Proposed OFT	17	159
On Going OFT	8	92
Technologies assessed (Completed OFT)	9	67
On farm trials conducted	17	159
Frontline demonstrations (FLD)		
Proposed Frontline demonstrations	22	366
On Going Frontline demonstrations	9	116
FLDs conducted on crops	11	171
Area under crops (ha.)	53.8	171
FLD on livestock/ AH enterprises	5	119
FLD on Fisheries	3	35
FLD on enterprises	2	40
FLD on Home Science	2	35

Trainings

KVK organised 54 trainings benefitting 1150 farmers / farmwomen, rural youth and extension functionaries. Apart from the mandatory works, the KVK has conducted 32 sponsored trainings benefitting 900 beneficiaries from different parts of Khordha district and Odisha state sponsored by development organisations.

Table 47. Training Programmes Organised by KVK

Training Programmes	No. of Course	Duration (in days)	Participants
Farmers	33	38	785
Farm women	9	9	225
Rural youth	7	35	60
Extension personnel	5	12	80
Vocational trainings	-	-	-
Sponsored Training	32	173	900
Total	**86**	**267**	**2050**

Intitiative of "People and Partnership"

KVK in 2013-14 set its target in expanding its activities in Khordha district by carrying out the works with the initiative of "People and Partnership". The initiative was centred on partnering with organizations of almost similar mandate to enhance reach of activities by keeping interests of people successfully achieved through synergic interventions. With this initiative KVK is at present has worked/working with partners like Employment Mission, ATMA-Khordha, Orissa Community Tank Management Project (OCTMP), District Rural Development Agency (DRDA), National Council of Rural Institutions (NCRI), Watershed Mission, Government of Odisha and Bringing Green Revolution to Eastern India (BGERI). CIFA declared this initiative "People and Partnership" as Slogan of the Year 2013.

Farmer to Farmer Extension Model

Realising the importance of farmer to farmer extension as a key for larger development, KVK with the support of OCTMP trained 180 master farmers of the Pani Panchayat (PP) i.e Water Users Association (WUA) from 30 districts of Odisha for five days in six batches. Master famers were trained in fish seed production and improved fish farming and it is expected that all the 180 in turn would help communities towards aquaculture development. This farmer-to-farmer-extension as a model adopted by KVK to maximize impact of the training progarmme. The impacts of these have been realised through the increased contact by master farmers to KVK for providing agro services through personal visits and online support.

Odisha Community Tank Management Project (OCTMP)

KVK-Khordha and World Bank funded Orissa Community Tank Management Project (OCTMP) agreed to jointly implement the Agricultural Livelihood Support Services (ALSS) Component in Khordha district. The joint implementation targets are to improve productivity in cereals, pulses, oil seeds, vegetables, fruits, strategic interventions in livestock, adoption of improved practices in fish culture and capacity building of lead farmers in 58 Minor Irrigation Projects (MIP) covering 65 Water Users Association (WUA)/Pani Panchayats (PP). The outcome of the activities covers 7556 ha benefitting 6000 farmers in agriculture / horticulture, 2000 in livestock and 500 households in fisheries in the command villages. The extension approach to be envisaged under this project is through Farmers Field School (FFS). The KVK organised an inception workshop for implementation of the project involving the project staff from OCTMP, Scientists from CIFA and KVK. With this project KVK has established two project site office for easy access and administration of activities in the operational area.

Watershed Mission, Government of Odisha

KVK was provided an opportunity to share the experiences with Naupada farmers on cultivation of off season vegetables. KVK took attempts to share the experience through training 210 farmers in seven batches. The initiative was supported by Watershed Mission, Government of Odisha. The KVK with the funds provided developed a guide for cultivating horticulture crops with special reference to off season vegetables. This partnership also yielded to work jointly with Department of Vegetable Science, Odisha University of Agriculture and Technology.

Promotion of State Schemes

Upon the request of District Collectorate, Khordha the KVK supported the District Fisheries Office, Khordha to organise a workshop and awareness camp on the new state scheme Promotion of Intensive Aquaculture. The workshop was held at KVK with 50 stakeholders comprising farmers, bankers and state officials for the promotion of new scheme. A district level training on the state scheme for financial assistance for SHGs on Financial assistance for drudgery reduction equipments was also held at KVK. The beneficiaries of the scheme attended the training. A demonstration of drudgery equipments was also conducted at KVK which benefited the trainers at the block level for further promotion of this state scheme.

Promotion of Rural Technologies

KVK joined with National Council of Rural Institutions (NCRI), Hyderabad to promote rural technologies among practicing farmers. The one day training was attended by 35 farmers which focussed on rural technologies viz., technologies extending shelf life of horticultural crops and value addition, commercial cultivation of Honey bee, vermin composting and bio-pesticide preparation and demonstration on preparation of Phenyl from cow urine. The rural technologies that were demonstrated in the training targeted towards developing entrepreneurship on the identified technologies. The focus was towards promoting "Low External Input Sustainable Agriculture (LEISA)" with the initiative of reducing purchased inputs. This training gave an opening to work on the promising rural technologies.

ATMA-Khordha

The KVK also works with ATMA-Khordha through a convergence model in varietal trails, demonstrations and trainings. KVK has been working with Bringing Green Revolution to Eastern India (BGREI) in promoting line transplanting and System of Rice Intensification. Since 2011-12, KVK and BGREI under ATMA has brought 10,000 ha of paddy cultivation under Line Sowing covering seven blocks, 554 villages with the role of KVK in technical backstopping and Monitoring. KVK-Khordha works in tandem with ATMA towards sharing responsibilities and using resources effectively. The convergence works done by KVK jointly with ATMA is presented below:

Table 48. Activities of KVK in convergence with ATMA

Year	Crop	Area (ha) Trans Planted	Coverage		No. of beneficiaries
			Block	No of Villages	
2011-12	Paddy	3000	3	62	4532
2012-13	Paddy	3000	3	96	4081
2013-14	Paddy	4000	5	97	5921

Workshops organised by KVK jointly with Zonal Project Directorate, ICAR, Jabalpur

KVK organised two workshops jointly with Zonal Project Directorate, ICAR, Jabalpur on Fishery technology and agricultural engineering for KVKs of Odisha, Chhattisgarh and Madhya Pradesh on May 1-2, 2013 and May 2-3, 2013 respectively. The workshops were organised to review the mandatory works of KVKs OFT, FLD and training and to approve the action plan for 2013-14. Programme Coordinators and SMS of KVKs attended the programme.

Refresher Training for Fisheries Extension Officers of Odisha

Two batches of Refresher Training on Sustainable Aquaculture Technologies for Fisheries Officers of State Department of Fisheries, Government of Odisha sponsored by Odisha Community Tank Management Project (OCTMP) was organised jointly by CIFA and KVK-Khordha during December 17-21, December 2013 and 3-7 February, 2014. The programme targeted 40 Assistant Fisheries officers to be empowered with knowledge on Sustainable Aquaculture technologies.

National Conference of KVKs

KVK-Khordha was selected to exhibit the activities at the National Conference on KVKs held at University of Agricultural Sciences, Bangalore from October 23-25, 2013. About 600 visitors visited KVK stall and the important visitors were Dr. B. Meenakumari, DDG (Fisheries), ICAR, Dr. P. Jayasankar, Director, CIFA, Dr. Anupam Mishra, ZPD, Dr. S. S. Nanda, Dean, Extension Education, OUAT and Dr. S. R. K. Singh from Zonal Project Directorate.

Krishi Vasanth-2014

KVK exhibited the activities in Krishi Vasanth 2014 KVK exhibited its activities at Krishi Vasant 2014 organised by Ministry of Agriculture, CII and Government of Maharashtra Nagpur during the period 9-13, February 2014.

Farmer-Scientist Interactions

KVK during the reporting period conducted five farmer scientist interactions on the topics viz., line transplanting in paddy, bitter gourd cultivation, practices of colacasia cultivation, brinjal cultivation and community based aquaculture. The interactions were supported by different agencies and 370 farmers benefitted.

Farm Innovators

KVK has initiated the identification of farm innovators in different fields of development. Four farm innovators in the district were identified and documented the innovations. The significant farm innovations were Poly plant production of Pointed gourd, proven and tested poultry feed supplied through contract farming, multipurpose use of fish ponds and overhead water storage for hatchery operations.

Performance of demonstration units of KVK

The KVK successfully established a low cost vermi compost unit and produced 1000 kg of vermi compost and eight Kg of worms, banana production unit depicting latest technologies and fingerling production. The KVK achieved the target of producing 2,87,550 fry and fingerlings earning a revenue of Rs. 2,32, 025. The KVK also produced planting materials of Onion (1.5 lakh seedlings), Capsicum (50,000 seedlings), pointed gourd (1300 poly plants) and tomato (13,000 seedlings). The dairy unit of KVK generated an income of Rs. 54,040 through the sales of 2702 litres of milk.

Thirteen farmers awarded for highest paddy yield

Thirteen farmers of KVK were awarded in different occasions by various agencies. Mr. Basudev Jena, a beneficiary of KVK, won State Award for highest paddy production in Khordha district with a cash prize of Rs. 10,000 instituted by Government of Odisha. KVK jointly with ATMA-Khordha recognised nine paddy farmers for achieving the best yield.

Special Day Celebrations

National Fish Farmers' Day

The Institute observed National Fish Farmers Day on 9 July, 2013. The chief guest on the occasion was Sri R.S. Gopalan, IAS, Director, Directorate of Agriculture and Food Production, Govt. of Odisha and the guest of honour was Mr. Bhibhu Prasad Kar, Assistant General Manager, NABARD, Bhubaneswar. Seventeen fish farmers from different parts of the country were felicitated and four publications in different languages were released on the occasion. The awarded farmers also made brief presentations of their way of farming fish and shared their views with the researchers and other farmers. In total 150 farmers and farm women attended the farmers-scientist interaction held on the same occasion.

Farmers meet

A farmers' meet was conducted in the adopted clusters of Mayurbhanj District consisting of 40 farmers including women SHG members adopting carp polyculture participated in the meet on 12 June, 2013 at Baradiha Village, Betnati Cluster and on 13 June, 2013 at Sagunibasa, Udala-Kaptipada Cluster and Kadalipal Village of Baripada Cluster respectively. The farmers expressed their happiness on the income generated from the aquaculture interventions. Mr. Sanjaya Kumar Sahu, a progressive farmer participated in the meet and interacted with the farmers.

Programmes undertaken by Hindi Cell

- The Institute observed the Rajbhasa Day on 21 September, 2013. The events like debate, essay and handwriting competitions were organized among the staff children and staff to spread the awareness on Hindi language in each and every Institute activities. The winners were awarded with prizes.
- A training on Fish culture in rural area was organized during 26 February – 2 March, 2013 in Hindi language for 15 fish farmers of Chattishgarh.

Vigilance Awareness Week

The Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar had observed Vigilance Awareness Week from 28th October to 2nd November, 2013. The theme of this year was 'Promoting Good Governance –Positive Contribution of Vigilance'.

The observance of the Vigilance Awareness Week commenced with the Pledge Taking Ceremony on 28th October 2013. On 31st of October 2013, a general meeting was conducted in the conference hall of CIFA. Sri Gopal Chandra Nanda, IPS, (Retd.) former Director General of Police, Odisha had addressed/interacted with the employees as Chief Guest. On this occasion, a brochure on the observation of Vigilance Awareness Week with the theme was released by the Chief Guest. Dr P. Jayasankar, Director, CIFA, in his presidential address, encouraged the employees to be courageous in raising voice against the corruption that comes to their notice.

Dr. S.K. Swain, Principal Scientist and the Vigilance Officer, CIFA, encouraged all to raise their voices and fight against corruption in every sphere of life. There apart, various activities like debates and essay competition among the nearby school students and staff, Research Scholars were also conducted during the week and prizes were distributed to the winners on 2nd November 2013 in the valedictory function presided over by Dr. P. Jayasankar, Director. Dr S.K. Swain, Dr B.K. Das and Sri K.C. Das organized the programme.

Establishement of Business Planning and Development Unit

With a mission, to provide the required infrastructural support and environment to entrepreneurs / business men in freshwater aquaculture and promoting incubatees for commercializing technologies developed at Central Institute of Freshwater Aquaculture (CIFA), one Business Planning and Development (BPD) Unit was set up in CIFA in June, 2013. The unit has the objectives viz., (a) To promote aqua-business entrepreneurs using aquaculture technologies; (b) To facilitate technology commercialization of technologies developed by CIFA; (c) To enhance human resource skill of entrepreneurs for aquaculture business. The project is in operation at CIFA since June, 2013.

In a short span of time this platform has provided an opportunity for entrepreneurs to share their ideas and knowledge with the technical community for a successful business enterprise. It encouraged them to take more aggressive role in designing and up-scaling the business while accessing technology of the central institute. Seven entrepreneurs could come up to the stage and signed MoUs with BPD, CIFA for defining new orbit of their business and to move on. BPD is under discussions with another 26 prospective entrepreneurs who are at different stages and some could reach the stage of signing the MoU.

The BPD has developed value added fish product like Rohu and Catla deboned fish, Fish fingers, Fish pickle, Fish fillet, Fish biriyani, fish pickle etc. Freshwater fish processing unit is developed and supported development of an innovative product-fish hydrolysate. These products were test marketed in the super market, hotels, restaurants, etc. The BPD has generated revenue generation Rs. 9.0 (Rupees Nine lakh) through incubation services and consultancy.

Many new infrastructure and facilities have been developed viz., Tilapia hatchery, Murrel hatchery, Technology park, three numbers of ponds etc. The models of the technology viz Magur hatchery, Carp hatchery, Demand fish feeder, Fish silos, etc are developed for display to the entrepreneurs. Business Plan Development (BPD) provides incubation facilities such as office space, access to information and communication of technologies, advice on management, marketing, technical, legal, IPR and financial issues A total of around 50 number of clients interacted and were provided with the support for business development

During this period four number of workshops viz, launching workshop, entrepreneurship meet, Workshop on CIFABROOD™, workshop on pre-commercialization of seven technologies was organized while the BPD has participated in seven workshops, exhibitions, etc.

The BPD has undertaken two of consultancies i.e one from RRA- network at a cost of Rs. 5.2 lakhs and Agriculture Promotions and Investment Corporation of Orissa (APICOL) at a cost of Rs. 2.0 lakhs. One more consultancy at a cost of Rs. 2.0 lakhs is under discussion. The BPD has prepared nine fliers, one product catalogue, one leaflets and several posters and banners for business promotion in freshwater aquaculture.

In future, BPD CIFA will upscale this novel beginning to realize the potential of the aqua-business in India.

Other Extension Activities

Workshop on Ornamental fish farming

An interactive workshop for Ornamental fish farmers of Patna and Keonjhar Sadar clusters at Sardhapur and Padmapur was conducted on 10-11 April 2013 respectively under the NAIP project on "Sustainable livelihood improvement through integrated freshwater aquaculture, horticulture and livestock development in Mayurbhanj, Keonjhar and Sambalpur Districts of Odisha" (Component-3). Participants (141 nos) of different women SHGs and individual farmers participated in the workshop. The successful SHGs and individual farmers adopting ornamental fish culture under NAIP were felicitated with prizes and certificates. During the workshop, the farmer's skill was enhanced on management, feeding and disease control measures besides other technical aspects of breeding and culture of egg layers and livebearers through multimedia programmes.

Farmers-scientists interaction at Kendrapara, Odisha

Farmers developmental Co-operative of Kendrapara, Odisha organized a farmer's scientist interaction on 20 June, 2013 at Kendrapara. Dr P. Jayasankar, Director CIFA was the chief guest and Dr B. C. Mohapatra, Dr B. K. Das were the guests of honor on this occasion. This programme was inaugurated by the District Collector Shri Niranjan Nayak. Seventy farmers including women representative participated in the program. This programme was mainly focused to provide solution to the problems faced by fish farmers. Dr P. Jayasankar advised farmers to take advantage of CIFA technologies for enhanced fish production and livelihood improvement.

Development of Ornamental Fish Villages

Villagers of Landijhari, Saruali and Nuagaon belonging to the Barkote Block, Deogarh District of Odisha have declared their villages as "Ornamental fish villages". The women as well as the unemployed youths of these villages have adopted ornamental fish culture to earn their livelihood by utilizing their leisure time. They are now able to generate Rs 10,000 - 15,000/- annually from ornamental fish culture with a minimal investment of Rs 3000 - 4000/- in 3-6 nos of cement tanks for breeding and culture of ornamental fishes. This has contributed significantly for building their confidence and helped in reducing drudgery for earning a livelihood.

One notable feature of this intervention is that the Institute had linked the products from the farmers to traders by establishing a marketing hub, assuring steady income from the sale of their produce. The concept of "Buy a fish- Save a family" has created a positive attitude among the fish loving buyers and traders for aggressive marketing. The ornamental fish villages are trading different species of live bearers like Guppy, Molly, Platy and Swordtail and some selected egg layers like gold fish and rosy barbs. The popularity of aquarium keeping has been attracting hobbyists and tourists to these villages. The technology has paved the way for self-employment and economic empowerment of women of that area.

Farmers meet at Ornamental fish village, Barkote

A farmers' meet was conducted at Barkote block on 13th December 2013. Twenty five ornamental fish farmers of Landijhari, Saruali and Nuagaon block had participated in the meet. During the meeting various difficulties faced by the farmers relating to ornamental fish culture were addressed. The Chairman, Barkote block had expressed his satisfaction with Dr P. Jayasankar, Director, CIFA, since the livelihood of the farmers is enhanced through ornamental fish farming in the adopted villages. Further, it was decided that the District Fishery Officer, Deogarh and Sri Panchanan Sahu, AFO, Barkote will provide necessary support for distribution of FRP tanks to the selected ornamental fish farmers in the adopted villages of Barkote block under horizontal expansion of NAIP.

Training Programme on "FRP Carp Hatchery Technology" under NAIP

A training programme on "FRP carp hatchery technology" was conducted for NAIP farmers and project personnel at CIFA, Bhubaneswar during 24-25 June 2013. Twenty four persons participated in the training programme. The participants were shown the installation of FRP carp hatchery, its operation and management. The participants were shown rohu breeding in the FRP carp hatchery.

NAIP training on FRP carp hatchery technology

Early breeding of Indian major carps at Sarkana, Odisha under CIFABROOD™ demonstration trial

CIFA has demonstrated a trail of CIFABROOD™ in Mr Batakrishna Sahoo farm of Sarkana Village, Balianta Block under Khurda District, Odisha. The feeding trial started on 18 February 2013 and fishes were fed @ 3% of body wt. with CIFABROOD™ in experimental pond, while farm made feed was provided in the control pond. Almost all the males as well as most of the females of rohu and mrigal and a few catla showed initiation symptom of phenotypic maturation within 30 days of feeding. Fishes were matured by the 1st week of April 2013 (48 days from feeding). First induced breeding program was conducted on 22 April, 2013 with mrigal broods using OVA-FH as inducing agent. Second breeding program was conducted on catla on 13 and 28 May, 2013 and rohu was bred on 31 May, 2013. The notable observation was 100% breeding response in all the three species tested with complete release of eggs (fecundity at par with rainy season) with fertilization rate and spawn recovery more than 90%. On contrary, not a single brood was ready for breeding operation in the control pond.

Early bred (April) spawn has already grown up to fingerling size by 15 June 2013, which is fetching Rs.1 per piece to the nursery growers. According to the spawn buyers survival rate of fingerling is in between 50-70% as compared to 30% normally observed during spawning season in previous years. Fingerlings are ready for stocking for grow out culture from June middle to October allowing an extra period of near about 3 months for growth purpose. The early breeding with the help of CIFABROOD™ will lead to a surge in the number of spawn buyers even in peak summer of coming years and is most likely to have many positive impacts in the aquaculture sector.

Preparation for induced breeding on 22 April 2013

Mrigal fingerlings ready for stocking on 15 June 2013

Scientist and Farmers interaction on CIFABROOD™

A farmer and scientist interaction was organized on 19 April, 2013 at the Field Station of CIFA, Kalyani. Scientific deliberation on CIFABROOD™ was made and its benefits and results obtained so far both at CIFA as well as in farmer's pond in West Bengal were explained. The meeting was attended by 21 progressive fish farmers/hatchery owners of West Bengal from 24-Parganas, Murshidabad, Hooghly, Midnapore and Burdwan Districts. Several hatchery owners wanted to get the feed for testing in their ponds immediately.

Dissemination of improved rohu

Under the dissemination program, intotal 265.15 Lakhs of Improved rohu " Jayanti" was produced and disseminated to states / Institutions like Odisha, Jharkhand, Assam, West Bengal, Bihar, Anadamans, CIFA production unit, KVK, NFFBB etc.Improved rohu spawn (Jayanti) had been distributed in different district of Orissa like Puri, Khurda, Kendrapara, Cuttack, Jharsuguda, Balasore, Baripada,Ganjam, Jajpur, Angul and Keonjar.

Expert Consultation on 'Water Resilient Aquaculture-Vision for 2050'

An Expert Consultation on 'Water resilient aquaculture - Vision for 2050' was held at the Institute on 6 September 2013. The following dignitaries were present on the occasion: Dr K.K. Vass, Former Director, CIFRI; Dr V.V. Sugunan, Former ADG (Fy), ICAR; Dr Arunabha Mitra, Prof. Aquacultural Engineering Section, IIT, Kharagpur; Dr Balaram Panigrahi, Prof. and Head, Soil and Water Conservation Engineering, CEAT, OUAT, Bhubaneswar; Dr Surendranath Pasupalak, Prof. & Head, Dept. of Agro-Meteorology, OUAT, Bhubaneswar; Dr Lalita Mohan Garnayak, Chief Agronomist, AICRP on Integrated Farming Systems, OUAT, Bhubaneswar. Dr S. Adhikari, Pr. Scientist, CIFA coordinated the programme.

Recommendations/Suggestions

- Introduction of water resilient fish species is required in the light of water scarcity
- Estimation of water requirement for different fish production system/process is required (species wise, system wise, stages wise, with or without aeration, etc.) so as to bargain with the Government/policy makers for accruing benefits to the fishery sector
- CIFA should conduct research to develop and standardize methodologies for estimating water productivity for different culture systems and culture operations
- Promotion of culture of water resilient species like catfish, murrel, koi, tilapia, etc. and short culture duration species, such as minor carps has to be encouraged
- Nutrient rich wastewater aquaculture could be utilized with due importance to biosafety
- Consolidated research on water budgeting, water use efficiency and water productivity should be prioritized
- Species diversification, multiple use of water, participatory water use, pricing of water, water legislation and incentives for efficient use of water and capacity building would go a long way in conservation and optimum use of water
- As a globally recognized research facility, the onus is on CIFA not only to estimate water productivity for fish production systems, but also to standardize the methodologies that can be followed by others
- Modification/fine tuning of the existing aquaculture practices in relation to lower water availability in terms of volume and periodicity, poor water quality and frequent draughts/floods is required
- Water requirement for producing 1.0 mmt of table size carp and 1.0 million carp seed has to be assessed
- By 2050, India has to produce 17-20 mmt of fish/year and the 80% of the total production must come from the aquaculture and therefore, it is essential to estimate the water requirement for increasing four folds our seed and fish production from the present level.

Secretary DARE & DG, ICAR inaugurates CIFA Livelihood support programme in Bali (Sunderban)

The second phase of implementation was inaugurated on 26 July 2013 by the Hon'ble Secretary DARE and DG ICAR Dr. S. Ayyappan in presence of Dr. S.D. Singh, ADG, Inland Fisheries; Dr. P. Jayasankar, Director, CIFA; Dr. B. Saha (IAS), Director of Fisheries, Govt. of West Bengal; Mr. F. Lepcha, Additional Director of Fisheries, Govt. of West Bengal; Shri Anil Mistry, Secretary, Wild Life Protection Society of India; along with scientists of NBSSLUP, Kolkata and CIFA (Dr P.P. Chakrabarti, Dr B.C. Mohapatra and Dr K. Kumar). The news got published in ICAR Website; ICAR Reporter; Fishing Chimes; CIFA Website; CIFA News; etc.

Organization of Consultation Workshop at Bali (Sunderban)

CIFA organized the Consultation Workshop on

"Development of Action Plan for Livelihood Options at Bali Island of Sunderban" on the occasion of Gandhi Jayanti (2 October 2013) with an objective of developing strategy for intervention of ICAR in the development of remote and underdeveloped islands of Sunderban. The programme was presided over by Dr S. Ayyappan, Secretary, DARE (Govt. of India) & Director General, ICAR. Twenty nine ICAR research institutes came together for dissemination and adoption of their respective technologies in Sundarban. Officials from West Bengal Fisheries Department, members of Wildlife Protection Society of India (WPSI), KVKs, NGOs and the villagers of Bali were present on the occasion. Four DDGs; National Director, NAIP; Dr. Bhargava, ICAR Governing Body Member and Swami Sibapurnananda (Prakash) Maharaj of Ramkrishna Mission, Belur Math were also present on the occasion. The news got published in ICAR Website; ICAR Reporter; ICAR Mail; DARE News; Fishing Chimes; CIFA Website; CIFA News; DD National; Bengali Newspaper, etc.

The programme was organized in three sessions. In the first session, DG, ICAR and other delegates visited the village, treading the arduous muddy road to the pond sites where CIFA technologies were implemented by beneficiaries; in the second Session, delegates interacted with village community on livelihood options related to agriculture, livestock and fisheries. In the third session, DG, ICAR reviewed and developed Action Plan for improvement of livelihood of Bali Island and utilization of TSP fund in the respective institutes for livelihood promotions in the tribal areas in India during the 12th Plan. Farm implements supplied by CIAE, Bhopal, value added products prepared by women folks, etc. were also exhibited.

While welcoming the grand assemblage of policy makers, research managers, and other stakeholders, Director, CIFA, Dr. P. Jayasankar thanked the DG, ICAR for making this event possible, and hoped that this ICAR endeavor would provide succor to the poverty stricken and hapless villagers of Bali. Shri Aravind Kausal, Secretary, ICAR urged the officials to draw inspiration from Mahatma Gandhi and Swami Vivekananda to uplift the under privileged community through concerted efforts. Dr. S. Ayyappan hoped that Bali would become a model for other backward and under developed regions for their development. He had a word of praise for CIFA for initiating this programme through its Tribal Sub Plan (TSP) scheme. The DDGs and Directors of various institutes have also expressed their opinion and offered unstinted support for any developmental activity in the region. They have discussed and deliberated a wide range of strategies and action plans. The consultation meeting recommended four important action points for the development of Bali:



- Integrated farming
- Screening of diseases before introduction of new livestock
- Development of marketing system
- Input and output management in the island

Considering the above points, DG, ICAR opined that strategically a strong coordination was required to implement all these programmes; Institutes like CSSRI, CRRI, NDRI, IVRI, CIFRI and CIFA could form a group and in association with ZPDs shall formulate, implement and monitor the entire programme. A committee consisting of above institute was formed under the chairmanship of DDG (Fy.) with CIFA as lead institute in implementing the strategy for the development of the island.



Organization of Scientists-Farmers Interaction Meet in Mayurbhanj District

CIFA organized the Scientists-Farmers Interaction Meet at Rajib Bhawan, Naupal G.P., Badasahi Block, Mayurbhanj District, Odisha on 30 December 2013. This meet was organized under the Tribal Sub-Plan Programme (TSP) in collaboration with State Fisheries Department. More than 100 fish farmers of Khunta, Udala, Moroda and Badasahi Blocks of Mayurbhanj district participated in this programme. The news got published in ICAR Website; CIFA Website; CIFA News; several Newspapers, etc.

Other Programmes

- Skill development programme on carp polyculture was arranged for a total of 51 beneficiary families at Bali Island, Sunderban, West Bengal. CIFA organized the Training Programme on "Seed production and culture techniques of carps and SIFs' at Wildlife Protection Society of India, Bali during 2-6 July 2013.
- On 11 December 2013, CIFA team participated in an Interaction Meet with fish farmers at Jammusahi, Dasapalla Block, Nayagarh District, Odisha under CIFA-TSP programme. Forty four farmers from seven villages namely Jammusahi, Durgaprasad, Dhudukipadu, Gunduriadia, Tangnali, Bhagamunda and Pamprada attended in the programme. Water samples from some ponds were taken to CIFA and analyzed for the physico-chemical parameter. Those were found within permissible limits for fish culture in that area

Outreach Activities

Three outreach activities have been initiated by the ICAR during the XIth Plan, considering the need for focused attention in some key areas of research that cut across the mandate of more than one Institute under the Fisheries Division. The thematic areas for outreach activities are fish feeds, fish genetics stock, nutrient profiling and evaluation of fish as a dietary component. These outreach activities are functioning under a consortium mode led by a Lead Institute in active parternership with other participating Institutes i.e., NBFGR, CIFRI, CIFT, CIBA, CMFRI and DCFR. This Institute is the Lead Institute for the outreach activity on fish feeds and participating Institute in the other two outreach activities.

Programmes on Television/Radio/Video films

Programmes on Radio by RRC, Bangalore: (i) Nutritional benefits of small indigenous fish species. Part of 'ArogyaPoshaka: Meenu' Radio show serial sponsored by NFDB. AIR-AM Broadcast on 28 February, 2014. (ii) Characterization of fresh fish and preservation." Part of 'Arogya Poshaka: Meenu' Radio show serial sponsored by NFDB. AIR-AM Broadcast on 14 March, 2014. (iii) Processed fishery products. Part of 'ArogyaPoshaka:Meenu' Radio show serial sponsored by NFDB. AIR-AM Broadcast on 21 March, 2014.

Radio talks

- Ornamental fish farming, Krushi Darshan, AIR, Bhubaneswar on 7 June, 2013 (S. K. Swain)

Television programme

- Success story of CIFABROOD™ was broadcasted by Doordarshan-ODIA in Krushidarshan programme on 18 July and 30 July, 2013.
- Delhi Doordarshan has telecasted three times the work of CIFA intervention like production of fishes, fish pickle preparation etc. for the tribals of Bali island Sundarban.

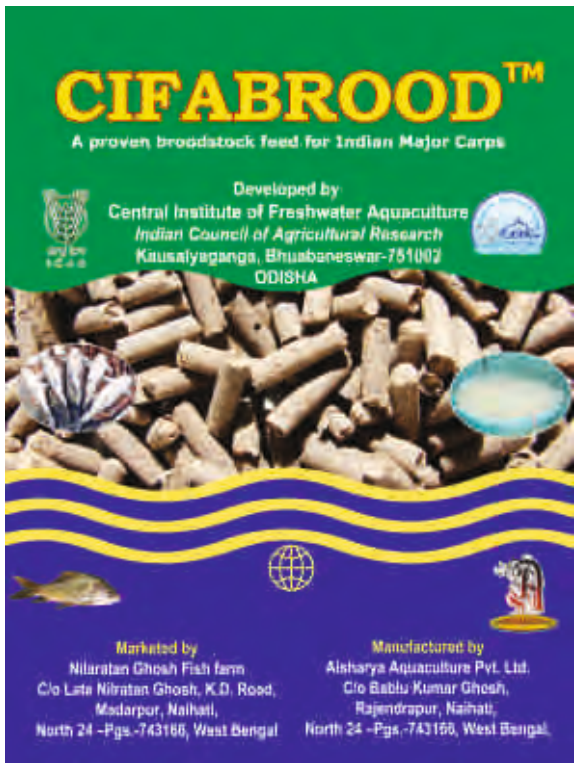
Video films

The following Video films were made by the Institute

- Aquaculture development at Keonjhar, Sambalpur and Mayurbhanj districts for livelihood development (English, Hindi and Odia)
- Documentary film on Landijhari ornamental fish village 'Ornamental fish farming for empowerment of women'
- Ornamental fish farming by women Self Help Groups
- CIFA aquarium- A paradise for ornamental fishes (Odia and English)

Commercialization/Transfer of Institute's products

The Institute commercialized three new technologies namely CIFABROOD™, "Shining Barb" and Quality Seed of striped catfish at a function at NASC Complex, New Delhi on 29 August 2013 chaired by Hon'ble Secretary, DARE & DG, ICAR Dr S. Ayyappan. Dr Raja Sekhar Vundru, Joint Secretary (Fy.), DADF was the Chief Guest of the occasion. Dr Vishnu Bhat, FDC, DADF; Dr (Mrs) B. Meenakumari, DDG(Fy.); Dr S.D. Singh, ADG (Fy.); Dr Madan Mohan, ADG (Fy); Dr C.S. Murthy, Executive Director, NFDB; Dr P. Jayasankar, Director, CIFA; Dr A.G. Ponniah, Director, CIBA; Dr T.K. Srinivasa Gopal, Director, CIFT; Dr J.K. Jena, Director, NBFGR; Dr A. Gopalakrishnan, Director, CMFRI; Dr S.K. Swain,



inventor scientist of "Shining barb", Dr. S. Nandi, inventor scientist of CIFABROOD™ and Dr B.S. Giri, inventor scientist of quality pangas seeds were present during the occasion. MoUs were signed between Director, CIFA and the entrepreneurs Mr Avijan Ghosh, M/s Aishrya Aquaculture Pvt. Ltd., Naihati, West Bengal and Dr Atul Kumar Jain, Director, M/s Tropical Aquaculture & Farming Systems (India), Udaipur, Rajasthan for transfer of CIFABROOD™ and "Shining barb" technologies, respectively. Mr. S. Suparna, M/s Sairam Hatchery Pvt. Ltd. West Godavari, Andhra Pradesh received seeds of pangas.

Shining Barb

Publicity through Print Media

The Social Science Section of the Institute is involved in highlighting the achievements of the Institute in the print and electronic media. During 2013-14, large numbers of news items were published in various news papers in English, Hindi and Oriya.

North-East Region Development

Under the Northeastern Development programme the following activities were undertaken by CIFA during the year 2013-2014.

- A training programme on "Installation of FRP carp hatchery" was organized in the Meen Bhawan, Directorate of Fisheries, Guwahati, Assam during 29-30 May 2013. There were 32 participants in the programme. The Director (Fy), Govt. of Assam, Mr. Deka was the chief guest of the inaugural session and others present were Mr S. Purkayastha, Deputy Director of Fisheries (GoA); and scientists from the Regional Centre, Rahara and Headquarters of CIFA. The participants were shown the installation of FRP carp hatchery, its operation and management at Assam State Farm, Ullubari. They were also shown the grass carp spawn that were produced in the FRP carp hatchery by the officials of Assam State Government at Ullubari.
- Dr K Das Mahapatra, principal Scientist organized Farmers meet for popularization of "Jayanti rohu, magur and minor carp in Assam" at Nalbari on 27 June, 2013.

Feasibility Study of Freshwater Pearl Culture in Meghalaya

As per request from the Principal Secretary of Fisheries, Govt. of Meghalaya a visit was made to conduct a survey regarding the feasibility of pearl culture in Meghalaya state. There was detail discussion with state officials like Principal Secretary, Director and other Fisheries Officials, Dept. of Fisheries; Officer-in-Charge North Eastern Regional Centre of Zoological Survey of India, Professors from NEHU and farmers of Garo hills over the matter and also the documents published from ZSI, North Eastern Region were also verified. It was found that mostly freshwater pearl mussel *Lamelidens corrianus* (Lea) has been found in East Khasi and East Garo hills, the warmer regions of Meghalaya. The climatic condition of Garo hill is also suitable for pearl farming. It was suggested that NEDFI and Government of Meghalaya can initiate pearl farming in their locality under technical guidance of CIFA.

Training programme and fish farmers field visit in Bodoland Territorial Council, Assam

Under NEH Programme of CIFA, one training programme on "Freshwater aquaculture" was conducted at Guwahati during 24 -25 November 2013. Dr P. Jayasankar, Director, CIFA along with scientists; officials of BTC and about 60 fish farmers from BTC (Bodoland Territorial Council), Assam attained this programme. Director, CIFA explained

the concept and prospect of AFS (Aquaculture Field School) for the benefit of fish farmers. The programme was coordinated by Dr. P. P. Chakrabarti, Pr. Scientist and Chairman of NEH programme. Dr. G. S. Saha, Dr. B. C. Mohapatra, and Dr. R. N. Mandal of CIFA attended the training as resource persons from CIFA side. Mr. P. Hazarika, Nodal Officer, BTC, coordinated the programme from BTC side.

The scientific team from CIFA visited the farmers' field and interacted with them in Baksa and Udal Guri Districts, BTC, Assam. There are potential resources existing in those areas in respect of aquaculture practice and better livelihood opportunities. At Rowta, the FRP carp hatchery set-up was inaugurated during the visit.

Consultative Workshop on "Self-sufficient and Sustainable Aquaculture in North Eastern Region" held at Agartala, Tripura

A consultative Workshop on Self-sufficient and Sustainable Aquaculture in North Eastern Region was organized by the Institute in collaboration with Department of Fisheries (Government of Tripura) at Pragna Bhawan, Agartala, Tripura on 5 February, 2014. Sri Manik Sarkar, Hon'ble Chief Minister of Tripura was present as the Chief Guest along with Sri Khagendra Jamatia, Hon'ble Fishery Minister of Tripura; Sri Santanu Jamatia, Hon'ble E.M (Fy.), Tripura Tribal Areas Autonomous District Council; Dr P. Jayasankar, Director, CIFA; Secretaries and Directors of Fisheries from different NEH States; Fisheries Advisor / Experts; Representatives from Bodo Territorial Council, Assam; Directors from CIFRI, ICAR-NEH Complex, Barapani, DCFR; Scientists from CIFA, CIFT, CIFRI, DCFR, NBFGR, KVKs of ICAR; College of Fisheries, Tripura; Progressive fish farmers from different States; and Govt. officials.

Several institutes like CIFA, CIFRI, NBFGR, DCFR, Govt. of Mizoram, Govt. of Tripura, KVK, Regional Station of ICAR complex of NEH States and BTC have installed eye catching stalls exhibiting their activities for aquaculture development in NEH region and their association with CIFA. Shri Manik Sarkar, Hon'ble Chief Minister inaugurated the exhibition and praised the initiatives. The technical session followed the inaugural programme. The scientists and farmers interaction was also organized during the programme.

Decisions taken for intervention of CIFA for future development of aquaculture in NER States

- To develop package and practices of breeding and culture of important indigenous fishes of the region.
- To establish disease diagnostic lab.
- To conduct training and demonstration in various fish culture techniques.
- Genetically improved fish species may be available to the State Fisheries Departments and selected farmers.
- Support for establishment of FRP carp and magur hatcheries in the region.

NEH activities under Field Station, Kalyani

- A quite a appreciable number of fish farmers (nearing 145) from most of NEH States were trained in CIFA HQ., RRC, Kalyani and concerned NEH States were trained in modern aquaculture techniques of fish farming.
- Trainings on "Integrated Farming System with Fish seed production and pisciculture" were held at Baksa, Udalguri and Tongla districts of BTC, Assam 24-26 November, 2013. Dr. P. Jayasankar, Director CIFA, P. P. Chakrabarti, B. C. Mahapatra, G. S. Saha and R. N. Mandal were the resource persons.
- The team surveyed 130 ponds (81 ha) and a proposal was submitted to the Director for adoption.
- A 36 number of carp and magur FRP hatchery were sent to NEH States. Seed production of carp and magur were reported to start from these hatcheries.This has given a big boost towards seed sufficiencies of NEH States.
- CIFAX and Immunoboost were sent to five NEH States as a measure of prophylactic measures in fish farming and to avoid fish diseases.
- A consultative workshop on "Self-sufficient and sustainable aquaculture in North Eastern Region" was held at Agartala, Tripura on 5th February, 2014, different dignitaries and participants like Fishery directors from different NEH States, Directors and scientists of various ICAR institutions, KVKs, Fishery collages & farmers etc attended the programme.
- A booklet on integrated farming "Maach- Prani-Ucchamulya sabjir Samanwita Palan" have been released in local language i.e. Bengali for easy understanding amongst the local farmers of Tripura.
- A pictorial book on Fish Farming for Earning have been released.
- Demonstration of Jayanti rohu and *Puntius javonicus* demonstration at kalangkapali, Nalbari, Assam has resulted a tremendous impact to the Dept. of Fisheries as well as the Hon'ble Chief Minister of Assam. The Chief Minister expresses that entire local assam rohu shall be replaced by CIFA evolved jayanti rohu as early as possible.

EDUCATION AND INFORMATION SYSTEM

Library

Dr. Hiraral Choudhuri Library is one of the library having good collection of books and journals on Fisheries and Aquaculture. It has around 7014 books/ monographs, 2900 back volume journals and other reference materials. The library has more than 200 members viz., scientists, technical officers and research scholars. Besides 1764 users (which includes Scientists, Technical Officers & Research scholars) of the library, 894 visitors from outside organisations utilised the library resources.

The library is fully automated with Koha Library Management software. The library is proud to be a part one of the partner of the NAIP's e-Granth project. Under this project the institute library implemented the Koha software for the library. For this implantation of software the necessary software, hardware was provided by the project.

A National workshop was also held at the Institute during the 19-20 March, 2014. The aim of the workshop was to sensitize and aware the library professionals, scientists and research scholars about the e-Granth project.

The users of the Library extensively used the Consortium of E-resources on Agricultures (CeRA). A user awareness programme on the CeRA was organized by the library during the year. In addition to above online access in CeRA, the libraryis providing Document Delivery services to various institutions (including the SAUs) under the NARS.

Dr. Hiraral Choudhuri Library subscribed 23 International and 44 Indian Journals for the year 2013. Rs 18 lakhs was spent for subscription of the subscription of foreign journals and Rs.86,895 was spent for Indian journals for the year 2013.

The library has been recognised as the FAO Depository Library and has a good collection of FAO Publications related to Fisheries and allied agricultural sciences.

To keep abreast the current developments, it also provides monthly 'Current Contents' service by compiling content pages of current journals received. The library also provides the photocopy facility. The library provides services to the Scientists and Technical Officers of Headquaters & Regional centres, and Scientists, Research Scholars, teachers, trainees, students and officials from other organizations. The library mails Institute's publications to all ICAR Institutes, other Research Organisations, State Fisheries Departments, Fisheries Colleges, KVKs, Entrepreneurs and Farmers to keep them abreast with latest developments in Freshwater Aquaculture. The library sends the important articles both to the internal users of the Institute as well as scientists and researchers from outside the institute.

The library also provides the photocopy facility, and during the year 2013-14 more than 85,000 copies have been photocopied. Most of the photocopies provided to the Scientists and technical staff of the institute and they were done from the holdings of the library.

The library also sending the new clippings about the fisheries and aquaculture sector and about the happenings of the Institute to the internal users

Prioritization, Monitoring and Evaluation (PME) Cell

During the year under report, the Prioritization, Monitoring and Evaluation Cell undertook the following activities:

- Documentation and dissemination of scientific output of the Institute through CIFA Newsletter, Annual Report and other publications
- Organizing monthly meetings of senior officers to discuss the monthly progress of various activities of the Institute including research, teaching, training, publications and other administrative and financial matters. The proceedings were prepared and follow-up action monitored.
- Assistance provided for conducting IRC and RAC meetings
- Correspondence with the ICAR Headquarters, ICAR Fisheries Institutes, SAU's and other organizations on various research issues
- Maintenance of Research Project Files
- Action taken reports on recommendations of ICAR Regional Committee Meetings
- Responses to Parliament queries on freshwater aquaculture

Publications

- Annual Report of the Institute for 2012-13
- CIFA News Vol. 20 (No. 2, 3, 4); Vol. 21 (No. 1)
- Research Project Proposals – 2013-14
- Training manuals for various training progammes
- Leaflets and Brochures
- CIFA: Vision 2050 (Draft)

Communication of reports

- Material for DARE-ICAR Annual Report 2013-14
- Action taken report on proceedings of the meeting of Directors of ICAR Institutes
- Monthly, quarterly and half-yearly progress reports to the Council
- Replies to Parliament queries
- RFD and Strategic Plan document



AWARDS AND RECOGNITIONS

Recepient/s	Award	Venue	Year
Asish Saha	Best Paper Presentation Award at the First International and Third National Conference on Biotechnology, Bioinformatics and Bioengineering (organized by Society for Applied Biotechnology)	Tirupati, Andhra Pradesh	28-29 June, 2013
KVK-Khordha	Best poster and presentation award for Annual Report of KVK-Khordha 2012-13 at the XX Zonal Workshop (organized by Zonal Project Directorate, Zone VII, Jabalpur, ICAR)	Deendayal Research Institute (DRI), Chitrakoot, Uttar Pradesh	June 21-13, 2013
P. N. Ananth	Best Poster Award during the XXI Zonal Workshop	KVK-Chitrakoot, Uttar Pradesh	23-26 June, 2013
B. C. Mohapatra	Chaudhary Devi Lal Outstanding All India Coordinated Research Project Award 2012	ICAR, New Delhi	16 July, 2013
Nirupama Panda	Distinguished Service Award by the Society of Biological Sciences and Rural Development on the occasion of National Symposium on Innovative and Modern Technologies for Sustainable Agriculture and Rural Development	Allahabad, Uttar Pradesh	19-20 October, 2013
S. K. Mohanty	Distinguished Service Award for outstanding contribution in the field of Library and Documentation from Society of Biological Sciences and Rural Development	Allahabad, Uttar Pradesh	19-20 October, 2013
P. K. Meher	Scientist of the year Award in the field of Fish Genetics and Biotechnology by Society of Biological Sciences & Rural Development	Allahabad, Uttar Pradesh	20 October, 2013

B.C. Mohapatra P. P. Chakrabarti K. Kumar	Letter of Appreciations from Fisheries Division (ICAR) for "Development of Action Plan for Livelihood Options at Bali Island of Sunderban" in West Bengal and taking efforts in a difficult tribal area like Bali, to improve the lives of the poor families in 2012-2013	ICAR, New Delhi	26 November, 2013
M. Mohanty, S. Patnaik, L. Sahoo, P. Das and P. Jayasankar	Best Poster award for the poster Cloning and characterisation of GHRHR and IGF1in Indian Major Carp, *Labeo rohita* (rohu)"	3rd International Science Congress, Coimbatore, Tamil Nadu	8-9 December, 2013
J. K. Sundaray	Applied Zoologist Research Association (AZRA) young Scientist award	CRRI, Cuttack	16 February, 2014
K. C. Das	Best Oral Presentation award in National Symposium on Indian Academy of Veterinary nutrition and Animal Welfare	Jammu	19-21 September, 2013

Academic Accomplishments / Recognitions

As per the communication (F.No.NFDB / Z-II / CIFA / IAP / PFRP-03 / 2013-14 / 1348 Dated 28 / 10 / 2013) received from the National Fisheries Development Board, Ministry of Agriculture, Govt. of India, Hyderabad the FRP Carp Hatchery Technology became a Technology for the whole nation.

CIFA Annual Day

The 27th Annual Day of CIFA was celebrated on 1st April, 2013. The guests on the occasion were Dr N. Sarangi, Former Director, CIFA; Dr T. Mahapatra, Director, CRRI, Cuttack and Dr Sudarsan Panda, Director, Nandankanan Zoological Park, Bhubaneswar who graced the occasion and distributed the CIFA Annual Awards (2012). More than 300 persons including farmers and retired employees of CIFA attended the function.

Apart from other celebrations, the CIFA Annual Awards (for the year 2012) were presented to the following:

Best Division/Section/Unit/Research Groups	:	Best Research Group - Argulosis: A comprehensive study (Dr P.K. Sahoo, Dr J. Mohanty, Dr Hemaprasanth, Dr S. Saurabh, Dr J.K. Jena, Late Dr B.R. Mohanty, Dr S.K. Garnayak, Ms Banya Kar, Ms Amruta Mohapatra)
Best Scientist	:	Dr. J. Mohanty
Best Technical Staff member	:	Shri Sisir Kumar Mohanty
Best Administrative Person	:	Shri J. Dalai
Best Skilled Support Staff/Field Staff	:	Shri Bijaya Bhoi
Award for Hindi work	:	Dr P.K. Meher
Best Extension worker	:	Dr. S.K. Swain
Best Research Scholar	:	Ms Banya Kar Ms Madhubanti Basu Mr. Dilip Kumar Bej
Awards for School Children	:	
Best girl child award for the highest scorer in class X in 2012		No nominee
Best boy child award for the highest scorer in class X in 2012		Mr. Arjun Dhir (S/o Mrs B.L. Dhir, Tech. Officer)

CIFA has instituted two scholarships for promoting academic excellence among the children of the staff. One, with a donation of Rs. 1,20,000 by Dr Hiralal Choudhuri in the memory of his father is named as 'Girish Chandra Chaudhuri Memorial Scholarship' and the other with a donation of Rs. 60,000 by Dr S. Ayyappan in the name of his mother and is named as 'Smt. S. Susheelamma Scholarship'. Applications are invited every year from the staff wards and the scholarship is given on the basis of merit. Director, CIFA is the Chairman and Dr Nirupama Panda, Technical Officer (T 7-8) is the Member-Secretary of these scholarship Committees. Two more awards i.e., Dr T. Ramaprabhu Memorial and Dr B. R. Mohanty Memorial for research scholars were instituted with donations from Ms Ramaprabhu and parents of Dr B. R. Mohanty.

Thre recipient of the above awards are as follows:

Girish Chandra Chaudhury Memorial Scholarship

Name	Class	Amount (Rs)
Sonali Priyadarsini	Graduation	3000.00
Nil	Graduation	3000.00
Ankeeta Priyam	XI-XII	2400.00
Sushila Shrabani	XI-XII	2400.00

Smt. S. Susheelamma Scholarship

Name	Class	Amount (Rs)
Saswati Mohapatra	IX-X	1800.00
Madhusmita Tarai	IX-X	1800.00
Ashis Abhisek	VII-VIII	1200.00
Nil	VII-VIII	1200.00

Dr T. Ramaprabhu Memorial Award

Name	Designation	Amount (Rs)
Sri Banikalyan Swain	SRF	5000.00

Dr B. R. Mohanty Memorial Award

Name	Designation	Amount (Rs)
Ms Madhubanti Basu	SRF	750.00
Ms Truptimayee Behera	SRF	750.00

Apart from these awards, prizes were also distributed to winners of various sports and cultural events organized by the Institute.

RESEARCH COORDINATION AND MANAGEMENT

Research Advisory Committee

The reconstituted Research Advisory committee (2013-2016) meeting was held at the Institute during 13-14 February, 2014. The Chairman of the committee was Dr. K. K. Vass, Former Director CIFRI, Barrackpore, Kolkata; and Members were Dr. S. D. Singh, ADG (In. Fy.), ICAR, New Delhi, Dr. P. Keshavanath, Former Dean, College of Fisheries, Mangalore, Dr. Lalit C. Garg, Scientist-G, Indian Institute of Immunology, New Delhi, Dr. P. Jayasankar, Director, CIFA and Dr. K. D. Mahapatra, Member Secretary. The major recommendations of the RAC are on following lines

- Scientists to work on physiological mechanism involved in stunted carp seed growth.
- Study to be conducted on water requirement for various aquaculture systems and different cultured species.
- Complete gene sequencing of Jayanti rohu should be done and compared with that of normal rohu. It may be done through outsourcing to cut down on time.
- This division while working on biotechnological interventions should take into consideration the immediate needs of aquaculture sector. There needs to be strong organic linkage between the Aquaculture production and Fish Genetics and Biotechnology divisions and effective interaction among the scientists of these divisions will further improve the production level.
- Need to evaluate economics of feed based, natural productivity (especially periphyton) based and their combination in aquaculture practices and develops a strategy for effective utilization of feed resources.
- The division appears to be more loaded with nutrition work, while very little effort is made to address physiological issues of fish. Greater emphasis on fish physiology research is needed.
- To create awareness about fish as health food among civil society through publication of popular pamphlets in local language/s, based on nutrient data of different fish species and age groups.
- Necessary action be initiated for patenting and trademarking of fish feed formulations developed by CIFA
- There is a need to develop mechanism for reliable estimate of economic loss in aquaculture production due to diseases.
- An exercise to rationalize project allocation among scientists may be carried out at the Divisional level.
- While pursuing high-end research in the area of fish disease, the scientists should also focus their attention to solve immediate fish health management problems faced by aquaculture farmers in the country.
- Social Science section should prepare proper guidelines for BPD entrepreneurship
- Supply of genetically improved prawn seeds to Karnataka farmers.
- Focus on dissemination and popularization of ornamental fish culture technology in Karnataka.
- Developing a protocol for breeding and seed production in peninsular carps.

- To work out on quantification of nutrient (nitrogen and phosphorus) utilization by fishes in wastewater aquaculture system.
- To estimate the pesticide level of fish cultured in wastewater at ppb and nanogram levels.
- Economic evaluation of different integrated models developed at Kalyani.
- RRC, Vijayawada should act as a window for technology transfer and CIFA's interventions in Andhra Pradesh.
- Development of ornamental fish village in Gujarat.
- To assess the scope for freshwater pearl culture in Gujarat.
- A list of diseases affecting freshwater fishes may be prepared and new diagnostic kits developed to tackle emerging diseases.
- Emphasis should be given on new target molecules for vaccine development and its mode of delivery.
- Develop database on the consumption of GnRH based inducing agents in India.
- Modification of existing technologies for increased fish production vis-à-vis decreasing resource base.
- Develop technology with specific focus on resource poor farmers.
- Carrying out research and developing appropriate intervention strategies to tackle impact of climate change on aquaculture.
- Develop a centralized storage of project-wise primary data for any future use.
- All HOD's to prepare a road map on priority to address the emerging issues of Aquaculture specific to each division.
- All HOD's to prepare a Vision of their respective divisions within the overall vision of CIFA. They should also identify field oriented problems faced by aquaculture farmers and find solutions within the tenure of present RAC.

Institute Research Council

The mid-term Institute Research Council (IRC) meeting was held on 8 January, 2014. The annual IRC meeting was held during 25-27 April, 2013 with Dr P. Jayasankar, Director as Chairman and Dr B. K. Das, Member Secretary. Discussions were held on the on-going 12 institute based projects, 31 externally funded projects, 3 outreach projects, women scientist projects funded by DST and other research programmes.

Institute Management Committee

The 36th Institute Management Committee meeting was held on 15 May, 2013 under the Chairmanship of Dr P. Jayasankar, Director, CIFA. It was attended by Mr Victor F. Dantas (Sindhudurg, Maharashtara); Dr Manoranjan Kar, Vice Chancellor, OUAT, Bhubaneswar; Sri N.K. Pradhan, Joint Director (Fy), Govt. of Odisha; Sri N.V.R.N. Murty, F&AO, CIFA as Members; Sri K. C. Das, AO, CIFA as Member-Secretary; Dr A. K. Sahu, HoD, APED, CIFA; Dr P. Das, HoD(I/C), FGBD, CIFA; Dr N. K. Maiti HoD(I/C), FHMD, CIFA; Dr S. S. Giri, HoD, FNPD, CIFA; Dr G. S. Saha, Incharge Social Science Section, CIFA; Dr P. Natarajan Ananth, PC, KVK, Khurda as Member-Invitees. Agenda items included confirmation of proceedings of 35th Institute Management Committee, discussions on highlights of research programmes of the Institute, procurement of equipment in 2013-14 under Plan budget and other items. Further the 37th Institute Management Committee meeting was held on 28 August, 2013 under the Chairmanship of Dr P. Jayasankar, Director, CIFA. It was attended by Prof. D. Satapathy, Director, College of Fisheries, Rangailunda; Sri N.V.R.N. Murty, F&AO, CIFA as Members; Sri K. C. Das, AO, CIFA as Member-Secretary; Dr S. S. Giri, HoD, FNPD, CIFA; Dr J. K.

Sundaray, HoD, FGBD, CIFA; Dr G. S. Saha, Incharge Social Science Section, CIFA; Dr P. N. Ananth, PC, KVK, Khurda as Member-Invitees. The agenda items were taken up in seriatim for discussion by the Member-Secretary.

Quinquennial Review Team (QRT) meeting (2008-2013)

The QRT meeting was held on 5 August 2013 at the Institute. Further, the QRT team visited the RRC of CIFA, Bangalore on 7 August 2013. The meeting was attended by Dr K.V. Devaraj (Chairman), Dr Y.D. Sharma, Dr Bechan Lal, Dr M.L. Bhowmik, Dr Syed Ahmed Ali, Dr R. C. Bhatta (Members). The meetings were coordinated by Dr P. Das, Principal Scientist, CIFA as the Member-Secretary, QRT. Water use is going to be the most important aspect in the coming decades. Efficient water budgeting through recirculation and reuse, and integrated farming should be the way forward said the Chairman of QRT. Scientists should work with the slogan "Half the water doubles the production". He emphasized to utilize the all types of water and land in a judicial way for better economic returns.

Workshops/Seminars

Final workshop of CIFA-Worldfish collaborative project on "Genetic improvement of freshwater prawn, *Macrobrachium rosenbergii* in India - Phase II

CIFA has organized the final workshop of the collaborative research project between CIFA and WorldFish Centre, Malaysia on "Genetic improvement of Freshwater Prawn Macrobrachium rosenbergii in India–Phase II" during 20-21 December, 2013. Dr. N. Sarangi, Former Director, CIFA inaugurated the workshop and stressed the need for efforts directed toward revival of the freshwater prawn industry in the face of declining production. Dr. P. Jayasankar, Director, CIFA highlighted the need for genetic improvement of freshwater prawn in order to enhance the productivity in a sustainable manner. Director, CIFA stated that selective breeding for improving the growth rate of freshwater prawn would largely contribute towards revival of the farming.

Dr. K. D. Mahapatra, Principal Scientist & Co-PI of the project gave a brief account of the project and informed that CIFA has initiated genetic improvement of M. rosenbergii through selective breeding in 2007 to improve the growth rate and come out with a faster growing strain of M. rosenbergii. The project has so far shown encouraging result with a cumulative selection response of 16% in 4 generations. Further the 3rd and 4th generation prawns have undergone on-farm testing at farmer's field in different districts of Odisha with promising results.

The inaugural session was followed by a technical session with presentations on various topics viz., Global status of freshwater prawn farming with special reference to India, genetic improvement of M. rosenbergii in India, genetic data analysis of freshwater prawn, on-farm testing of selectively bred freshwater prawn, QTL mapping in candidate shrimp species and brood bank – a tool to revive the freshwater prawn farming. The second day of the workshop was devoted to Scientist-Farmer interaction where several prawn farmers from the state shared their experiences on the culture of freshwater prawn. Scientists and experts addressed the problems raised by farmers and provided solutions. Shri Krishna Mohan, Director Fisheries, Odisha and assistant director fisheries from 17 districts of Odisha also had participated in the plenary session. Dr. B. R. Pillai, Principal Scientist and PI of the project while briefing the state fisheries officials on the project stated that the new improved breed of *M. rosenbergii*, which is the result of nearly six years of dedicated work of the project team now need to reach to the end user for which the help of state fisheries department is vital and solicited their help and cooperation. Director, Odisha fisheries department has agreed to help in disseminating the improved breed of freshwater prawn.

National Sensitization Workshop on Quality Fish Seed: Principles vs. Practices

A National Sensitization workshop on " Quality Fish Seed : Principles Vs Practices" was organized at CIFA, Kausalyaganga, Bhubaneswar under the NFDB funded project on" Brood stock development and quality seed production of

improved freshwater carps, catfishes and prawn: prerequisite for NFFBB" at the Institute during 23-24 September, 2013 in collaboration with the National Fisheries Development Board (NFDB), Hyderabad. In the workshop, 32 participants from 17 states have participated. During the inaugural session, Dr. P. Jayasankar, Director of CIFA welcomed the guests and addressed the gathering. Dr. N. Sarangi, Former Director, CIFA was the chief guest and Dr. C.K Murty, NFDB was the guest of honour. Dr. J.K Jena, Director, NBFGR also addressed the gathering. During the two days workshop, awareness was created for importance of quality seed in increasing production level of fish. Different aspects, ways and means for stock improvement, and quality seed production were discussed in detail for major carps, minor carps, prawn and catfishes. State-wise problem identification was done and demand for different species was also evaluated. The workshop was coordinated by Dr. Kanta Das Mahapatra, Principal Scientist & PI of the project.

National workshop on Library Automation using Koha Software under e-Granth

The National Workshop on Library Automation using Koha software under e-Granth was organized on 19-20 March, 2014 at the Insitute. The aim of the workshop was to sensitize and create awareness among the library professionals, scientists and research scholars about the e-Granth project.

The e-Granth project was started with 12 partners. In 2013 26 more partners joined this project and CIFA is also one of them. The project was started with following objectives.

- To create Online Public Access Catalog (OPAC) under "Indian Agricultural Research Group Catalogue" of all 12 library resources with Online Library Center (OCLC) partnership.
- To digitize important institutional repositories including rare books and old journals and make them open access under NARS.
- To strengthen capacity building for library and information management system (open to all libraries of NARS)
- Implementation of KOHA Library management Software in SAUs/ICAR

Dr. P. Jayasankar, Director, CIFA, in his inaugural speech gave a detailed account on the e-Granth project. He stressed that the quick access to right information has become important to optimize the agricultural output. The guest of honor Dr. K. Veeranjaneyulu, CCPI, e-Granth, ANGRAU, Hyderabad delivered a brief note. The chief guest Dr. H. Chandrasekharan, Head, AKMU, CPI, CeRA, and Co-PI, e-Granth, IARI, New Delhi presented a brief account. This was followed by technical sessions.

HUMAN RESOURCE DEVELOPMENT

Foreign Assignments

Sl. No.	Events/Training	Venue	Period	Participant(s)
1.	Meeting on Aquaculture and Homestead for the research project "Increasing the resilience of Agricultural and Aquaculture Systems in Coastal Areas of the Ganges Delta".	World Fish Dhaka, Bangladesh	7-12 April, 2013	J. K. Sundaray
2.	Meeting on Homestead Production System under the research project "Increasing the resilience of Agricultural and Aquaculture Systems in Coastal Areas of the Ganges Delta".	World Fish, Malaysia	15-21 September, 2013	J. K. Sundaray
3.	Training in the area of Marker assisted selection (Fisheries Science)	University of Stirling, Scotland, UK	30 October, 2013 - 28 January, 2014	Rajesh N
4.	Aquaculture conference: To the Next 40 Years of Sustainable Global Aquaculture.	Palacio de Congresos de Canarias, Las Palmas, Gran Canaria, Spain	3 -7 November, 2013	K. D. Mahapatra
5.	Training in the area of Stem Cell Research (Fisheries) under NAIP fellowship	Rutgers-The State University of New Jersey, USA	4 November 2013 - 04 February, 2014	S. Saurabh
6.	Workshop on Promising aquaculture technologies & management systems, and the future of global fish supply	World Fish, Malaysia	17-21 November, 2013	J. K. Sundaray
7.	25th Governing Council meeting of NACA	Vientiane, Lao PDR	24-28 March, 2014	P. Jayasankar

Training received by the staff members of the Institute as part of the human resources development initiative

Sl. No.	Events/Training	Venue	Period	Participant(s)
1.	Competency enhancement Programme for Technical Officers of ICAR Institutes	NAARM, Hyderabad	13-22 May, 2013	U. L. Mohanty Nirupama Panda
2.	Write-shop for Success Stories	MANAGE, Hyderabad	19-23 August, 2013	A. K. Dash P. R. Sahoo
3.	Advances in Experimental Designs for Development of Technologies in Agriculture	IASRI, New Delhi	23 October - 12 November, 2013	S. Ferosekhan
4.	Online Examination Training	ASRB, New Delhi	21-22 November, 2013	A. S. Mahapatra, D. P. Rath
5.	TOT for District Level Officials on "Financial Assistance to Women SHGs for drudgery reduction"	DRWA, Bhubaneswar	22-23 November, 2013	A. K. Dash
6.	Training programme on Entrepreneurship Development and Management	EDI, Ahmadabad	9-13 December, 2013	P. N. Ananth
7.	Training for Animal Science and Fisheries	OUAT, Bhubaneswar	17 January, 2014	B. Behera B. K. Banja P. R. Sahoo
8.	Koha software for Integrated Library Management	CIFRI, Barrackpore	17-19 February, 2014	S.K. Mohanty R. Das
9.	Training program on "Computational Aspects for NGS Data Analysis: A Sojourn from Lab to Field"	Anand Agriculture University, Anand	4-13 March, 2014	L. Sahoo

Participation of Scientists/Technical Officers in Workshops/Seminars/ Symposia/Conferences/ Meeting in India and abroad

Events	Venue	Duration	Participant(s)
International Seminar on "Current status of Ar-F pathogen in water"	Kalyani University	1 April, 2013	P. P. Chakrabarti
Meeting at ASRB	New Delhi	4 April, 2013	P. Jayasankar
Formulation of inter-Institutional collaborative project in view of farming system research	PDFSR, Modipuram	10-12 April 2013	P. P. Chakrabarti R. N. Mandal
2nd Advisory committee meeting of Hilsa project	CIFRI , Barrackpore	13-14 April, 2013	D.N.Chattopadhyay
AIZWV National Symposium – 2013	Odisha Veterinary College, Bhubaneswar	19-22 April, 2013	S. C. Rath Ashis Saha
First Fishpedia Workshop	CMFRI, Cochin	29-30 April, 2013	A. S. Mahapatra N. K. Barik
54th City Official Language co-ordination meeting	Income Tax Office, Bhubaneswar	30 April, 2013	P. K. Meher

Review cum Action Plan Workshop on Fishery Technology	Zonal Project Directorate, Zone VII, ICAR, Jabalpur	1-2 May, 2013	Rajesh Kumar
Review cum action plan workshop on Fishery technology during 2nd May 2013.	KVK, Khurda	2 May, 2013	K. D Mahapatra
The krishi Mahotsav at Nadiad	Nadiad, Gujarat	14 May, 2013	C. K. Misra
Meeting regarding QRT, Vision-2025 and EFC of CIFA	ICAR, New Delhi	16 May, 2013	P. Jayasankar
Special meeting on Implementation of CIFA aquaculture technologies	Agartala, Tripura	16 May, 2013.	P.P. Chakraborti P.L. Lalrinsanga
International Seminar on "Greening Fisheries''	CIFT, Cochin	21-23 May, 2013	P. Jayasankar P. P. Chakrabarti R. N. Mandal
Brackishwater Aqua Farmers meet – 2013	Kakdwip Research Centre of CIBA	25 May, 2013	J. K. Sundaray
The Krishi Mahotsav at Khambat	Khambat	28 May, 2013	Subhas Sarkar
DBT task force meeting	New Delhi	28-29 May, 2013	P. Jayasankar
Meeting at ASRB	New Delhi	31 May, 2013	P. Jayasankar
International workshop on Status of good practices and lessons learnt in aquaculture in the SAARC Region	CMFRI, Cochin	5 June, 2013	P. Jayasankar
Intensive Workshop on High Resolution Mass Spectrometry	Institute of Bioinformatics, Bangalore	15-23 June, 2013	J. Mohanty
Fish Farmers' Meet and Banana Shrimp harvest programme in Navsari	Navsari, Gujarat	18 June, 2013	C. K. Misra
XXI Zonal workshop of KVKs	DRI, Chitrakoot, UP	19-23 June, 2013	P. N. Ananth P. R. Sahoo
Zonal workshop on KVKs of Zone-VII, ICAR	KVK, Satna, Chitrakoot, UP	21-23 June, 2013	P. Jayasankar
Agri-business management	Gangtok	24 June, 2013	K. N. Mohanta
Farmer-scientist interaction meet (organized by Farmers Development Co-operative Ltd., Kendrapara)	Kendrapara, Odisha	26 June, 2013	P. Jayasankar B. C. Mohapatra B. K. Das
Farmers meet for popularization of "Jayanti rohu, magur and Minor carp in Assam"	Nalbari, Assam	27 June, 2013	K. D. Mahapatra
Third National Conference on Biotechnology, Bioinformatics and Bioengineering (organised by Society for Applied Biotechnology)	Tirupati, Andhra Pradesh	28-29 June, 2013	Ashis Saha
First Meeting of Scientific Panel on Fish and Fisheries Products	Food Safety and Standards Authority of India, Ministry of Health & Family Welfare, New Delhi	2 July, 2013	P. Jayasankar

Workshop on Stratergies for Strenghthening NARS Libraries under e-Granth	IARI, Pusa, New Delhi	5-6 July, 2013	S. K. Mohanty
Management Development Training Program on Biotechnology & Intellectual Property Rights	NAARM, Hyderabad	8-12 July 2013	P. Das
ICAR Foundation Day celebration	ICAR, New Delhi	16 July, 2013	P. Jayasankar
Directors Conference	NAAS, New Delhi	17 July, 2013	P. Jayasankar
Agri-tech Investors Meet	ICAR, New Delhi	18-19 July, 2013	P. Jayasankar
Third Annual Review Workshop of the NFBSFARA Project (AS-2001)	NASC Complex, Pusa, New Delhi	22-23 July, 2013	M. Samanta D.N.Chattopadhyay
Review Meeting of KVKs in Odisha	OUAT, Bhubaneswar	24 July, 2013	P. N. Ananth
Farmer's Mela (programme on TSP of CIFA)	Sunderban, West Bengal	24-27 July, 2013	P. Jayasankar
Workshop on Livestock Production and Management Technologies	ZPD, Zone-VII, JNKVV Campus, Jabalpur	26-27 July, 2013	B. K. Banja
Agri-business camp	CARI, Andaman & Nicobar Islands	27 July, 2013	P. Swain
Expert consultation on fish genomics research in India: A way forward	NBFGR, Lucknow	1-3 August, 2013	P. Jayasankar J. K. Sundaray P. Das M. Samanta L. Sahoo
Expert Consultation on 'Fish Genomics research in India: A way forward'	NBFGR, Lucknow	2 August, 2013	J. K. Sundaray P. Das L. Sahoo
Preliminary meeting of QRT of CIFA with DDG(Fy.), ICAR	ICAR, New Delhi	3 August, 2013	P. Jayasankar
QRT visit and Meeting	RRC of CIFA, Bengaluru	7 August, 2013	P. Das
Workshop on 'Water quality issues, opportunities and socio-cultural concerns of wastewater use in agriculture'	DWM, Bhubaneswar	7-8 August, 2013	S. Adhikari
Workshop on Specialized KVKs	KVK-Kanker, Chhattisgarh	8-11, August, 2013	P. N. Ananth
Coordination committee meeting of the NFBSFARA project on 'Stock characterization, captive breeding, seed production and culture of Hilsa'	CIFRI, Barrackpore	16 August, 2013	P. Jayasankar
Discussion with the Commissioner of Fisheries, Govt. of Gujarat	Anand, Gujarat	17-18 August, 2013	P. Jayasankar
Agri-Hort Investors Meet	ICAR at New Delhi	18-19 August, 2013	P. N. Ananth
Meeting with Commission-cum-Secretary on Development of Fishery Hub at Kausalyaganga, Bhubaneswar	Secretariat, Govt. of Odisha, Bhubaneswar	22 August, 2013	P. Jayasankar
QRT visit and Meeting	CIFA, RRC, Rahara/Kalyani	27 August, 2013	P. Das
Meeting on Repeat study on assessment of post-losses of major horticultural crops, animal and fishery products in India	NASC Complex, New Delhi	29 August, 2013	P. Jayasankar

Conference on the "Current Nutritional Concepts for Productivity enhancement in Livestock and Poultry"	TANUVAS, Kottupakkam, Chennai	29-30 August, 2013	N. Sridhar
Workshop on KOHA-Integrated Library System	CPCRI, Kasargod	29-30 August, 2013	S. K. Mohanty
Meeting on Outreach network projects/Agri-consortia platform	NASC Complex, New Delhi	30-31 August, 2013	P. Jayasankar S. S. Giri B. N. Paul
QRT visit and Meeting	CIFA, RRC, Gujarat	2 September, 2013	P. Das
International Krishimela	GKVK Campus, UAS, Bengaluru	4 September, 2013	M. R. Raghunath
Knowledge Seminar by Perkin Elmer	Kolkata	6 September, 2013	B. N. Paul
Participation in QRT meeting of CIFA	RRC, Vijayawada	15-16 September, 2013	P. Jayasankar P. Das
Workshop on Fish disease surveillance	NBFGR, Lucknow	17-20 September, 2013	P. K. Sahoo B. K. Das
Meeting at SMD, ICAR regarding pending work in connection with Labour, works and recruitments and discussion with DG, ICAR on Bali programme.	ICAR, New Delhi	18-22 September, 2013	P. Jayasankar
2nd National Conference of Indian Academy of Veterinary Nutrition and Animal Welfare on "Nutrition-Health Interactions for Optimum Livestock Production & Human Welfare"	Sher-e-Kashmir University of Agricultural Sciences Technology, Jammu	19-21, September, 2013	S. S. Giri B. N. Paul K. C. Das
Empanelment of District and Block level Trainers under OLM	DRDA, Khordha	20-24 September, 2013	A. K. Dash
Zonal Research and Extension Advisory Committee meeting of Anand Agricultural University prior to Rabi Season	AAU, Anand	23 September, 2013	C. K. Misra
Farmer-Scientist interface meeting on Utilization of Paddy fallows of Coorg dist at KVK	Gonikoppal, Coorg, Karnataka	25 September, 2013	B. Gangadhar
Mid-term review of the Foreign aided projects	KAB II, New Delhi	27 September, 2013	B. R. Pillai
BPD meeting	Kalyani, Field Station	28 September, 2013	N. K. Barik
Consultative workshop on Development of Action Plan for Livelihood options in Bali, Sundarban	Bali, Sundarban	1-3 October, 2013	Director and scientists from headquarters and RRC, Rahara and Kalyani
Scientists interaction meeting	DCFR, Bhimtal	3-4 October, 2013	P. K. Sahoo K. D. Mohapatra B. R. Pillai
Scientist interaction meeting	DCFR, Bhimtal, Uttarakhand	1-6 October, 2013	B. R. Pillai
Workshop of ICAR- All India Coordinated Research Project on Application of Plastics in Agriculture	JAU, Junagadh, Gujarat	7-9 October, 2013	B.C. Mohapatra B. B. Sahu N. K. Barik
8th Scientific Advisory Committee Meeting" of Krishi Vigyan Kendra	Nayagarh, Odisha	10 October, 2013	S. C. Rath

Interface meeting with farmers, scientists and extension official	AAU, Anand, Gujarat	10 October, 2013	P. Jayasankar
Meeting with Vice-Chancellor, AAU, Anand in connection with land for RRC, Anand	AAU, Anand, Gujarat	11 October, 2013	P. Jayasankar
Symposium on Innovative and modern technologies for sustainable agriculture and rural development	Allahabad	19-20 October, 2013	P. K. Meher
3rd Advisory committee meeting of Hilsa Project	CIFRI, Barrackpore	22-23 October, 2013	D. N. Chattopadhyay
8th National Conference on KVK-2013	UAS, Bengaluru	23-25 October, 2013	P. Jayasankar P. N. Ananth B. K. Banja
Interface meeting	RRC of CIFA, Bengaluru	24 October, 2013	P. Jayasankar
National Workshop on Koha Library Management Software	Directorate of Oilseed Research, ICAR , Hyderabad	25-26 October, 2013	S. K. Mohanty
Liquid Chromatography by Waters India	Salt Lake City, Kolkata	6 November, 2013	B. N. Paul
3rd meeting of sub-committee for studying the potential and viability of culturing endemic and exotic species	CIBA, Chennai	7-8 November, 2013	P. Jayasankar J. K. Sundaray
DBT Task Force meeting	ICAR, New Delhi	11-12 November, 2013	P. Jayasankar
Meeting with SMD and Director of Works	ICAR, New Delhi	13 November, 2013	P. Jayasankar
Seminar on Recent advances in fisheries & aquaculture	CIFE, Mumbai	13-16 November, 2013	S. K. Swain
2013 NextGen Genomics and Bioinformatics Technology	IGIB, New Delhi	14-16 November, 2013	L. Sahoo
Conference on Aquaculture and Farmers' Consortium (jointly organized by Nagarjuna University, Andhra Pradesh and RRC of CIFA, Vijayawada)	Vijayawada, Andhra Pradesh	15 November, 2013	P. Jayasankar
Workshop on Koha Under e-Granth	OUAT, Bhubaneswar	16 November, 2013	S. K. Mohanty
Workshop on 'Understanding and Planning Fishery Development in Rain fed Agricultural Areas of India' (organized by RRA Network at Hyderabad)	APARD, Hyderabad, Andhra Pradesh	19-20 November, 2013	N. K. Barik
1st Ever Meen Mahatsov	Itanagar, Arunachal Pradesh	21-22 November, 2013	P. L. Lalrinsanga S. Ferosekhan
National Symposium on "Advances and applications of diagnostic pathology for disease management in livestock, poultry, pet, fish, laboratory animal and wildlife"	College of Vety. Sc. & Animal Husbandry, Bhubaneswar	21-23 November, 2013	P. K. Sahoo
Meeting on Fisheries and Aquaculture Development in West Bengal	CIFE Centre, Kolkata, West Bengal	23 November, 2013	P. Jayasankar
Sensitization workshop on Biotechnology	Utkal University, Bhubaneswar	23-24 November, 2013	J. K. Sundaray

3rd meeting of DST project Evaluation Group on State S&T Programme (SS&T)-Location Specific Research and Technology Development (LSR&TD)	Guwahati, Assam	25-26 November, 2013	P. Jayasankar
ICAR-SAU-State Interaction meet	CRRI, Cuttack	26-27 November, 2013	L. Sahoo
Workshop on "Hindi Karyasala"	DMAPR, Anand	27 November, 2013	C. K. Misra Subhas Sarkar
Preparatory Meeting on Observance of Pani Panchayat Fortnight-2013	Bhubaneswar	28 November, 2013	P. N. Ananth A. K. Dash
Discussed on the road map for development of scampi culture in India	ICAR, New Delhi	28 November, 2013	P. Jayasankar
Review meeting of the WorldFish funded collaborative project by DG	Krishi Bhavan, ICAR	28 November, 2013	Bindu R. Pillai
AusAID Ecotoxicology Workshop on safe water for the future	NBFGR, Lucknow	2-6 December, 2013	R. N. Mandal B. Mishra
Meeting with DG, ICAR; Legal Advisor and Deputy Secretary on administrative matter (legal, labour and work)	ICAR, New Delhi	5-6 December, 2013	P. Jayasankar
National Seminar on Bio prospecting of Natural Products	Burdwan University, W.B.	5-6 December, 2013	B. N. Paul
3rd International Science Congress	Karunya University, Coimbatore, Tamil Nadu	8-9 December, 2013	L. Sahoo
Training on Entrepreneurship Development and Management	EDII, Ahmedabad, Gujarat	9-13 December, 2013	P. Ananth
Participated in the CAS meeting	ASRB, Pusa, New Delhi	10 December, 2013	P. Jayasankar
Advisory Committee Meeting of the NFBSFARA (AS-2001)	Dept. of Zoology, Delhi University, Delhi	10 December, 2013	M. Samanta
Participated in the CAS meeting	ASRB, Pusa, New Delhi	13 December, 2013	P. Jayasankar
National symposium on 'Managing Natural Resources for enhancing Agricultural and Allied Productivity in Coastal Region under Changing climate'	CSSIR, Bharuch, Gujarat	11-14 December, 2013	R. N. Mandal
Workshop on Big Fish (IMC) Production	Kolkata, WB	12 December, 2013	D.N.Chattopadhyay
Fish Festival (organized by Department of Fisheries, Govt of Odisha)	Mondei Ground, Nabarangpur, Odisha	13-14 December, 2013	J. K. Sundaray
District level Fish Festival of Nabarangapur District	Dept. of Fisheries, Govt. of Odisha	14 December, 2013	J. K. Sundaray
Seminar on Utilization of microbes for sustainable development	OUAT, Bhubaneswar	14-15 December, 2013	P. Swain
National Symposium on New Technology in Agriculture: Oportunities and Challenges	CIFE, Mumbai	14-16 December, 2013	P. K. Meher
Participated in discussion on Next Generation Sequencing outsource	AAU, Anand	19-20 December, 2013	P. Das
Asia-Pacific Congress of Virology 2013	Amity University, Noida, New Delhi	17-20 December 2013	P. K. Sahoo

Workshop on Library management	CIFRI, Barrackpore	21 December, 2013	P. P. Chakrabarty R. N. Mandal
Participated in the TSP programme	Baripda, Mayurbhanj, Odisha	28-30 December, 2013	P. Jayasankar
National Workshop cum Training Programme on Koha LMS modules	University of Agricultural Sciences, GKVK, Bengaluru	3-4 January, 2014	S. K. Mohanty
Meeting with SMD for finalization of SFC document of CIFA	ICAR, New Delhi	12-14 January, 2014	P. Jayasankar
Mid term Review meeting of ICAR Regional committee -II	CIFRI, Kolkatta	24 January, 2014	P. V. Rangacharyulu
Ornamentals Kerala 2014	Dept. fo Fisheries, Govt. of Kerala	26-28 January, 2014	S. K. Swain
Technology Week for Women in Agriculture (EXHIBITION)	DRWA, Bhubaneswar	27 January, 2014	U. L. Mohanty
Project Review meeting of M.rosenbergii brood bank project by NFDB	College of Fisheries, Nellore, AP	1 February, 2014	P. V. Rangacharyulu
Final review workshop-NAIP	NASC Complex, New Delhi	2-5 February, 2104	S. K. Swain
Final review workshop on NAIP livelihood project	New Delhi	3 February, 2014	S. C. Rath
Consultation workshop on Self-sufficient and sustainable aquaculture in North-eastern Region	Agartala, Tripura	5 February, 2014	Director and other scientists
Zonal Research and Extension Advisory Committee meeting of Anand Agricultural University (AAU) prior to Kharif Season	Bansilal Amrutlal College of Agriculture, AAU, Anand	10 February, 2014	C. K. Misra
23rd Scientific Advisory Committee meeting of KVK, Devataj	KVK, Devataj, Anand	11 February, 2014	Subhas Sarkar
Krishi Vasanth	Nagpur	12 February, 2014	P. N. Ananth
Group monitoring workshop of DST/SERB funded project under PAC-Animal Sciences	JNCASR, Jakkur, Bengaluru	16 February, 2014	P. Jayasankar
AZRA silver jubilee International Conference on Probing Bioscience for Food Security and Environmental Safety	CRRI, Cuttack	16-18 February, 2014	J. K. Sundaray
Kofa e-granth training held at during.	CIFRI, Barrackpore	17-19 February, 2014	R. N. Mandal
Quarterly review Meeting for Monitoring of ALSS activities	Khordha, Odisha	19 February, 2014	P. N. Ananth A. K. Dash B. K. Banja
Agricultural Research Sub-Committe (AGRESCO) Animal Production meeting of AAU	Bansilal Amrutlal College of Agriculture, Anand Agricultural University, Anand	20-21 February, 2014	C. K. Misra Subhas Sarkar
Eastern Zone Regional Agricultural Fair, 2013-14	CRRI, Cuttack	26-28 February, 2014	Rajesh Kumar

National Conference on Wet lab mitigation and adaptation strategy in wet land	CIFRI, Barrackpore	1-2 March, 2014	P. P. Chakrabarti
Seminar on "Food Security and Sustainable agriculture"	Ramkrishna Mission Ashram Narendrapur Kolkata	2 March, 2014	P. P. Chakrabarti
CARI-NAIP Workshop on 'Backyard poultry production as a tool to augment livelihood of rural and tribal farmers of Odisha'	OUAT, Bhubaneswar	3-4 March, 2014	B. K. Banja
Training Programme on "Computational Aspect for NGS Data Analysis: A Sojourn from Lab to Field (under NAIP funded project Establishment of National Agricultural Bioinformatics Grid in ICAR)	Ome Research Facility, AAU, Anand	4-13 March, 2014	Lakshman Sahoo
Adoption of high tech Israeli technology on producing seeds of *Clarius batracus* at Digchiring, Fish farm, Tura, Garo hills	CIFE, Kolkata	10 March, 2014	P. P. Chakrabarti
Joint Working Group for the Agricultural Development of Jharkhand	ICAR, New Delhi	10 March, 2014	P. Jayasankar
Participate in the final fish harvesting programme	Hathakhola Village, Bali Island, Sundarban	11 March, 2014	P. Jayasankar
Scientists-Farmers Interaction meeting	RRC of CIFA, Anand, Gujarat	13-17 March, 2014	P. Jayasankar
NAIP-Terminal Workshop of Component-4	IARI, Pusa, New Delhi	19-20 March, 2014	M. Samanta
Awareness workshop on Challenges and opportunities in Intellectual Property management and commercialization of Technologies in Fisheries and Agriculture Sector.	NBFGR, Lucknow	20 March, 2014	J. K. Sundaray
Next Generation Sequencing: Challenges and Opportunities	School of Biotechnology, KIIT University, Bhubabneswar	25 March, 2014	J. K. Sundaray P. Das P. K. Meher Lakshman Sahoo
Seminar on "Impact of climate change on aquaculture and mitigation options for food security"	ICEE, Dept. of Environmental Management, University of Kalyani, West Bengal	25-26 March, 2014	S. Adhikari
Conference on Research, innovation and higher education-cooperation and opportunities between India and Europe	Bhubaneswar	28 March, 2014	S. S. Giri
National Seminar on "Emerging trends in Biotechnology: Present Scenario and future Dimensions"	Utkal University, Bhubaneswar	29- 30 March, 2014	J. K. Sundaray P. Das Lakshman Sahoo
International Symposium on'Greening Fisheries-Towards Green Technology in Fisheries'	CIFT, Kochi	21-23 May, 2014	N. Sridhar M. R. Raghunath B. Gangadhar C. H. Raghavendra

EXHIBITIONS

The Institute participated in the following exhibitions during 2013-14.

	Exhibition	Venue	Period
1.	Exhibition on ornamental fish culture was organized in the interactive workshop (organized by RRC of CIFA Anand)	RRC, CIFA, Anand	18 April, 2013
2.	Exhibition during CRRI Foundation Day celebration	CRRI, Cuttack	23 April, 2013
3.	Tamil Nadu Fish Festival (organized by RRC, Bengaluru)	Chennai	9-12 May, 2013
4.	Farmers Day celebration on the occasion of Akshya Tritiya (participation by KVK and CIFA)	Odisha Krushak Samaj at Balianta Block	13 May, 2013
5.	Greening Fisheries' International Symposium (organized by RRC, Bengaluru)	Kochi	21-23 May , 2013
6.	4th Krishi Fair 2013	Puri, Odisha	23 May, 2013
7.	Krishi Mela (participation by RRC, Anand)	Limkheda District Gujarat	27-28 May, 2013
8.	An exhibition stall in the Krishi Mela programme organized by Anand Agricultural University (organized by RRC of CIFA Anand)	Limkheda, Dahod, Gujarat	27-28 May, 2013
9.	Exhibition held in connection with Fish Festival	Balasore, Odisha	19 June, 2013
10.	Exhibition held in connection with "Expert consultation on fish genomics research in India – a way forward"	NBFGR, Lucknow	2 August 2013
11.	17th National Science Exhibition (organized by RRC, Rahara)	Belur, Howrah	21 -25 September, 2013
12.	Exhibition on the occasion of World Food Day	Orissa Krushak Samaj, Bhubaneswar	16 October, 2013
13.	National Conference on KVKs	UAS, Bengaluru	23-25 October, 2013
14.	Exhibition held in connection with International Krishi Mela (participated by RRC of CIFA, Bangalore)	UAS, Bengaluru	7-11 November, 2013
15.	1st Ever Arunachal Meen Mahotsav 2013" organized by the Department of Fisheries, Arunachal Pradesh	Itanagar, Arunachal Pradesh	21-22 November, 2013

16.	Exhibition on the occasion of ICAR Institute-State Agriculture University (SAU), State Department Interface Meet for the year 2013-14	CRRI, Cuttack	26-27 November, 2013
17.	"Exhibition on Fisheries" (Matsya Pradarshani)	Saundad, Gondia district, Maharastra	27 December, 2013
18.	Exhibition at Krishi mela organized by ATMA (organized by RRC of CIFA Anand)	Anand, Gujarat	31 December, 2013 and January, 2014
19.	Technology Week for Women in Agriculture	NRCW, Bhubaneswar	22-27 January, 2014
20.	India International Aquashow (organized by RRC, Bengaluru)	KOCHI, KERALA:	24-28 January, 2014
21.	Exhibition during National Consultation Workshop on Self-sufficient and sustainable aquaculture in North-eastern Regional	Agartala, Tripura	5 February, 2014
22.	Farmers Fair-cum-Exhibition organized by KVK, Dhenkanal in collaboration with LORD	Dhenkanal, Odisha	14-15 February, 2014
23.	Matsya Mela (organized by RRC, Bangalore)	Shimoga, Karnataka	15-17 February, 2014
24.	Eastern Zone Regional Agricultural Fair, 2013-14 (CIFA adjudged as 2nd best stall)	CRRI, Cuttack	26-28 February, 2014

BUDGET

Provision from the ICAR (2013-2014)

Sl.No.	Sub-head	Non-Plan						Plan	
		Govt. grant	Allocation internal + additional amount provided by Hqrs out of council's share	Total allocation (col 3+4)	Exp. out of Govt. grant	Exp. out of revenue generation	Total Exp. (col 6+7)	Allocation	Exp.
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1.	Capital Exp.								
a)	Land	102.65		102.65	102.65		102.65		
b)	Building								
c)	Equipments	5.00	5.00	10.00	4.99	5.00	9.99	103.00	102.88
d)	Furniture/Fixture							32.00	31.99
e)	Info. Tech.							10.00	9.99
f)	Library Books							25.00	24.82
2.	Revenue Exp.								
a)	Estt. Charges	1619.31		1619.31	1554.50		1554.50		
b)	Wages	69.50		69.50	62.74		62.74		
c)	OTA	0.40		0.40	0.40		0.40		
d)	Pension & Other Retirement benefits	150.00		150.00	129.01		129.01		
3.	Loans & Adva.		15.00	15.00		10.77	10.77		
4.	TA	12.00		12.00	11.99		11.99	22.00	21.88
5.	Other Charges								
a)	Res. Expenses	84.70	10.00	94.70	84.70	10.00	94.70	256.00	107.17
b)	Operational Expenses	72.30	10.00	82.30	72.29	10.00	82.29		148.83
c)	Admn. Expenses	82.08	124.11	206.19	81.89	124.11	206.00	147.00	146.97
d)	Misc. Expenses								
6.	HRD							10.00	9.89
7.	NEH							100.00	98.58
8.	TSP							39.00	38.68
	TOTAL	**2197.94**	**164.11**	**2362.05**	**2105.16**	**159.88**	**2265.04**	**744.00**	**741.68**

CIFA family wishes you a happy and peaceful retired life
We are grateful for your contributions and dedicated service

SUPERANNUATION
(2013-14)

Sri C. C. Samal, S.S.S. w.e.f. 30 April, 2013

Sri Y. R. G. Rao, Tech. Assistant w.e.f. 30 April, 2013

Sri P. C. Behera, Asstt. Administrative Officer w.e.f. 31 May, 2013

Sri Banamali Behera, Assistant w.e.f. 30 June, 2013

Sri Chhakei Behera, LDC w.e.f. 31 December, 2013

Sri Golekh Parida S.S.S. w.e.f. 28 February, 2014

Sri Jayaram Das, S.S.S. w.e.f. 28 February, 2014

DISTINGUISHED VISITORS

Kausalyaganga, Bhubaneswar

- Shri G. C. Pati, IAS, Secretary, Department of Animal Husbandry and Dairying, Krishi Bhawan, New Delhi (15 April, 2013).
- Dr M. V. Rao, Chief Executive, NFDB, Hyderabad (5 June, 2013).
- Mr. Christer Jungsand and Ms Annika Andersson from Sweden and Mr Rajen Kaul, Mr N. K. Bannerjee and Pravu Prasad from India visited the Institute demonstrated about their product RAS, Wallenius Water (13 June, 2013).
- Dr A.E. Eknath, DG, NACA, Bangkok visited the Institute during 25-27 July, 2013. He had interactive meetings with the Director, Heads of Divisions and scientists and also visited the farm facilities during the visit.
- Dr K.V. Devaraj (Chairman), Dr Y.D. Sharma, Dr Bechan Lal, Dr M.L. Bhowmik, Dr Syed Ahmed Ali, Dr R. C. Bhatta (Members) attended the QRT meeting held at the Institute (5 August, 2013).
- Dr Maroti Arjuna Upore, Consultant, World Bank Fisheries (31 August, 2013).
- Mr Phillip Otter from Germany, Dr. Nadeem Khalil, Assistant Professor, Aligarh Muslim University, Dr. Susmita Lahiri, Assistant Professor, International Centre for Ecological Engineering visited the RRC of CIFA, Rahara to discuss different aspects of sewage fed aquaculture activities (2 September, 2013).
- Dr P. R. Bhatnagar, Project Coordinator of AICRP on APA, HQ, Ludhiana visited the Cooperating Centre at CIFA, Bhubaneswar (6-9 December, 2013).
- Dr K. K. Vass, Former Director, CIFRI; Dr V. V. Sugunan, Former ADG(Fy), ICAR; Prof. Arunabha Mitra, IIT, Kharagpur; Dr Balaram Panigrahi, Prof. and Head, Soil and Water Conservation Engineering, CEAT, OUAT, Bhubaneswar; Dr Surendranath Pasupalak, Prof. & Head, Dept. of Agro-Meterology, OUAT, Bhubaneswar; Dr Lalita Mohan Garnayak, Chief Agronomist, AICRP on Integrated Farming Systems, OUAT, Bhubaneswar on the occasion An Expert Consultation on 'Water resilient aquaculture-Vision for 2050' (6 September, 2013).
- The reconstituted Research Advisory committee (2013-2016) meeting was held at the Institute. The Chairman of the committee was Dr. K. K. Vass, Former Director CIFRI, Barrackpore, Kolkata; and Members were Dr. S. D. Singh, ADG (In. Fy.), ICAR, New Delhi, Dr. P. Keshavanath, Former Dean, College of Fisheries, Mangalore, Dr. Lalit C. Garg, Scientist-G, Indian Institute of Immunology, New Delhi (13-14 February, 2014).

Regional Research Centre of CIFA, Vijayawada

- Dr S. Ayyappan, Secretary, DARE and DG, ICAR visited the RRC of CIFA, Vijayawada on 10 August, 2013. He observed the pangas seed produced under the NFDB sponsored project and also observed the disease resistant rohu fingerlings and ornamental fish unit. He interacted with the fish farmers of the region and staffs of the Regional Centre.

- Dr S. Ayyappan. Secretary DARE & DG, ICAR visited the Centre (14 November, 2013).

- Dr J. K. Jena, Director, NBFGR, Lucknow (14 November, 2014).

Regional Research Centre of CIFA, Anand

- Dr M.L.Bhowmick, Dr Y.D.Sharma, Dr R.C.Bhatt and Dr Bechan Lal Members of QRT of CIFA visited the centre during 01-03 September 2013.

- Dr. J.K. Jena, Director, NBFGR, Lucknow (20 December, 2013).

Regional Research Centre of CIFA, Rahara and Field Station, Kalyani

- Dr. J. K. Jena, Director, NBFGR, Lucknow visited the Integrated farming system complex of Fish cum livestock cum High value Agri horti crop (13 January, 2014).

- Dr B. Meenakumari, Deputy Director General (Fy) visited the Integrated farming system complex of fish cum livestock cum high value agri horti crop (25 January, 2014).

- Some scientists visited this pertaining to waste fed aquaculture on from Germany, Assistant professor of Aligarh muslim university and Susmita lahiri from International Centre for Ecological Engineering and discussed with them sewage fed aquaculture along with field survey (2 September, 2013).

Regional Research Centre of CIFA, Bangalore

- The Quinquennial review team of CIFA comprising of Dr.K.V.Devaraj, (Chairman), Dr. Y. D. Sharma, Dr. BechanLal, Dr. S. A. Ali, Dr. M. L. Bhowmick (members) and Dr. P. Das (Member-Secretary) held their meeting at the Center to review the Center's work for the period (7 August, 2014).

PUBLICATIONS

Research Papers

Adhikari, S., B. C. Sahu, A. S. Mahapatra and L. Dey, 2014. Nutrient budgets and effluent characteristics in giant freshwater prawn (*Macrobrachium rosenbergii*) culture ponds. Bulletin of Environmental Contamination and Toxicology, 92: 509-513.

Adhikari, S., R. Lal and B. C. Sahu, 2013. Carbon footprint of aquaculture in eastern India. Journal of *Water and Climate Change*, 4(4): 410-421.

Adhikari, S., R. Lal and Han-Ping Wang, 2014. Carbon sequestration in the soils of aquaculture ponds, crop land, and forest land in southern Ohio, USA. *Environmental Monitoring and Assessment,* 186: 1569-1574.

Ashe, S., U. J. Maji, R. Sen, S. Mohanty and N. K. Maiti, 2013. Specific oligonucleotide primers for detection of endoglucanase positive Bacillus subtilis by PCR. 3 Biotech DOI10.1007/s13205-013-0177-6.

Basu, M., N. K. Maiti., M. Samanta, 2013. Toll-like receptor (TLR) 4 in mrigal (Cirrhinus mrigala): Response to lipopolysaccharide treatment and *Aeromonas hydrophila* infection. *Int Res J. Biological Sci.*, 2(4): 20-27.

Behera, T. and P. Swain, 2012. Surface modified poly-ε-caprolactone microspheres as an antigen carrier using outer membrane nano vesicles of *Aeromonas hydrophila*. *Vaccine* 30, 5278-5284.

Behera, T. and P. Swain, 2013. Alginate-chitosan-PLGA composite microspheres induces both innate and adaptive immune response through parenteral immunization in fish. *Fish and Shellfish Immunology* doi.org / 10.1016/j.fsi.2013.06.012.

Behera, T. and P. Swain, 2013. Antigen encapsulated alginate coated chitosan microspheres stimulate both innate and adaptive immune responses in fish through oral immunization. *Aquaculture International*, DOI: 10.1007/s10499-013-9696-8.

Behera, T., P. Swain and D. Mohapatra, 2013. Virulence determination of bacterial isolates through culture in India ink including broth. *Journal of Microbiology and Antimicrobials*, 5(8): 87-90.

Behera, T., P. Swain, P. V. Rangacharulu and M. Samanta, 2013. Nano-Fe as feed additive improves the hematological and immunological parameters of fish, *Labeo rohita* H. *Applied Nanoscience*, DOI 10.1007 /s13204-013-0251-8.

Bindu R Pillai, Kanta D Mahapatra, Raul W Ponzoni, Lopam udra Sahoo, P L Lalrinsanga, Wagdy Mekkawy, Hooi Ling Khaw, Nguyen H Nguyen, Swagathika Mohanty, Sovan Sahu, Gunamaya Patra , 2014. Survival, male morphotypes, female and male proportion, female reproductive status and tag loss in crosses among three populations of freshwater prawn *Macrobrachium rosenbergii* (de Man) in India. *Aquaculture Research*. 03/2014; DOI:10.1111/are.12419 : 1-12.

Chinmayee Mohapatra, Swagat Kumar Patra, Rudra Prasanna Panda, Ramya Mohanta, Ashis Saha, Jatindra Nath Saha, Kanta Das Mahapatra, P. Jayasankar and Hirak Kumar Barman 2014. Gene structure and identification of minimal promoter of Pou2 expressed in spermatogonial cells of rohu carp, *Labeo rohita*. *Mol. Biol. Rep.*, DOI 10/1007 (s)11033-014-3283-6.

Das, A., P. K. Sahoo, J. Mohanty, and S. K. Garnayak, 2013. Purification and molecular

characterization of IgM in olive barb, *Puntius sarana*. *J. Immunoassay Immunochem*, DOI:10.1080/ 15321819.2013.848814.

Das, B. K., I. Sahu, S. Kumari, M. Sadique and K. K. Nayak, 2014. Phenotyping and whole cell protein profiling of *Edwardsiella tarda* strains isolated from infected freshwater fishes. *Int. J. Curr. Microbiol. App. Sci*., 3(1): 235-247.

Das, B. K., P. Pattnaik, C. Debnath, D. K. Swain and J. Pradhan, 2013. Effect of β glucan on the immune response of early stage of *Anabas testudineus* (Bloch) challenged with fungus Saprolegnia parasitica. *Springer Plus*, 2: 197.

Das, Jayakrushna, I. Nath, R. K. Das, P. Routray, S. S. Behera, 2012. Autologous stem cell therapy to treat chronic ulcer in heifer-A case study. *Vet. World*, 5(12), 771-774.

Das, Jayakrushna., I. Nath, P. Routray, R. C. Patra, R. K. Das, G. K. Purohit, S. S. Behera, 2012. Autologous-based therapy in chronic ulcerative wound at carpal region in a bullock. *Indian Journal of Veterinary Medicine,* 32(2): 84-89.

Das, S. P., D. Bej, S. Swain, L. Sahoo, C. K. Misra, J. K. Jena, P. Jayasankar and P. Das, 2014. Population Divergence and structure of *Cirrhinus mrigala* from peninsular rivers of India revealed by cytochrome b gene and trans morphometric analysis. *Mitochondrial DNA*, 25(2): 157-164.

Das, S. P., D. Bej, S. Swain, P. Das, B. K. Chaudhary, J. K. Jena, P. Routray, S. K. Swain, P. C. Das, and P. Jayasankar, 2013. Comparative and evolutionary analysis of mitochondrial genes in Indian major carps. *Biochemical Systematics and Ecology*, 47: 56-73.

Dash, Pujarini, Banya Kar, Arpita Mishra and P. K. Sahoo, 2014. Effect of Dactylogyrus catlaius (Jain 1961) infection in *Labeo rohita* (Hamilton 1822): Innate immune responses and expression profile of some immune related genes. *Indian J. Exp. Biol*., 52: 267-280.

De, H. K., G. S. Saha and P. Jayasankar, 2013. Twenty five years of freshwater aquaculture extension research in the Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha – A review. *Indian J. Fish*., 60(3): 135-139.

De, H. K., G. S. Saha and Radheyshyam, 2013. Aquaculture field school to promote farmer-to-farmer extension. *Journal of Global Communication*, 6(2):77-85.

Dey, M. M., P. Kumar, O. L. Chen, Md. A. Khan, N. K. Barik, L. Li, A. Nissapa and N. S. Pham, 2013. Potential impact of genetically improved carp strains in Asia. *Food Policy*, 43: 306-320.

Ekka, A., P. K. Katiha, A. Pandit, N. K. Barik, S. Salim and B. Ganesh Kumar, 2012. Socio-economic status of fishers of reservoirs In India. *Journal of the Inland Fisheries Society of India,* 44(2): 71-78.

Garnayak, S. K., J. Mohanty, T. V. Rao, S. K. Sahoo and P. K. Sahoo, 2013. Vitellogenin in Asian catfish, *Clarias batrachus*: Purification, partial characterization and quantification during the reproductive cycle by ELISA. *Aquaculture*, 392-395: 148-155.

Ghosh, T. K., B. K. Paul, D. N. Chattopadhyay and R. N. Mandal, 2013. Duckweed (Lemna minor) as fish ingredient for fry of common carp (*Cyprinus carpio*). *J. Inland Fish Soc. India*, 45(1): 19-25.

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PERSONNEL

(as on 31.3.2014)

Director

Dr P. Jayasankar

Head of Division

Dr S. S. Giri

Dr J. K. Sundaray

Dr S. S. Mishra

ICAR National Fellow

Dr P. Swain

Dr P. K. Sahoo

Principal Scientist

Dr M. R. Raghunath

Dr N. K. Maiti

Dr N. Sridhar

Dr Hemaprasanth

Dr S. K. Swain

Dr K. D. Mohapatra

Dr P. Das

Dr P. V. Rangacharyulu

Dr P. P. Chakraborty

Dr (Mrs) Saroj Toppo

Dr S. Adhikari

Dr Bindu R. Pillai

Dr J. Mohanty

Dr B. N. Paul

Dr G. S. Saha

Dr S. K. Sahoo

Dr Samiran Nandi

Dr P. Routray

Dr B. C. Mohapatra

Dr B. K. Das

Dr P. C. Das

Dr S. Mohanty

Dr H. K. Barman

Dr K. N. Mohanta

Senior Scientist

Dr B. B. Sahu

Dr S. C. Rath

Dr D. N. Chattopadhyay

Dr P. K. Meher

Dr R. N. Mondal

Dr Ashis Saha

Dr J. N. Saha

Dr M. Samanta

Dr B. S. Giri

Dr Gangadhar Barlaya

Dr Chandra Kanta Misra

Dr K. C. Das

Programme Coordinator

Dr P. N. Ananth

Scientist (Senior Scale)

Sri A. S. Mahapatra

Sri N. K. Barik

Scientist

Dr Lakshman Sahoo

Dr Shailesh Saurabh

Dr Rajesh Kumar

Dr C. Devraj

Sri P. L. Lalrinsanga

Sri Rajesh N.

Sri Ramesh Rathod

Dr Subhas Sarkar

Dr Khuntia Murmu

Technical (T-9)

Dr Balaram Behera

Ms B. L. Dhir

Technical (T-7-8)

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Sri Surendra Singh

Dr B. K. Banja

Sri Satyendu Sarkar

Dr N. Panda

Dr B. K. Pandey

Technical (T-6)

Ms Sukanti Behera

Sri Suresh Chand

Dr D. K. Verma

Dr U. L. Mohanty

Sri P. R. Sahu

Technical (T-5)

Sri S. Mahali

Sri Sovan Sahoo

Sri D. P. Rath

Sri S. K. Mohanty

Sri P. B. Bhakat

Dr Bibhudatta Mishra

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Sri Suratha K. Naik

Technical (T-4)

Sri Rabindra Das
Sri J. K. Ghosh
Sri B. Tata Rao
Sri Dukhia Majhi

Technical (T-3)

Sri C.H. Raghavandra
Sri Aruna Kumar Behera
Sri Lingaraj Muduli
Sri Debendra Tarai

Technical (T-2)

Sri R. C. Swain

Security Officer

Sri Debabrata Sahoo

Compounder

Sri Aurobinda Patra, T-4

Mike Operator

Sri Bhagabat Ch. Das, T-3

Powertiller Operator

Sri Affcer Mohamad, T-3

Drivers

Sri B. K. Behura, T-5
Sri Rabindra Tarai, T-5
Sri Alekh Nayak, T-3
Sri G. Vadi Velu, T-3
Sri Trinath Behura, T-2
Sri K. C. Das, T-2
Sri S. C. Panda, T-2
Sri Dinabandhu Pradhan, T-1
Sri Sibo Prasad Behera, T-1

Administrative Officer

Sri K. C. Das

Finance and Accounts Officer

Sri N. V. R. N. Murty

Asst. Finance and Accounts Officer

Sri S. S. Mahapatra

Private Secretary

Sri M. D. Das

Assistant Administrative Officers

Sri J. R. Biswal
Sri Indramani Muduli
Sri P. K. Sethy

Assistant

Ms Golap Bhanja
Sri S. Nandi
Sri Birabar Amanta
Sri A. K. Prusty
Sri Jitendranath Jena
Sri T. K. Mishra
Sri P. R. Srivastava

Upper Division Clerk

Sri Swamiji Sen
Sri Sukanta Sarkar
Sri R. K. Behera
Sri S. K. Rath
Sri Niranjan Behera
Sri Sukhendu Biswas

Lower Division Clerk

Sri Arijit Panda
Sri Rajesh Ku Das (Deptn)
Sri Prakash Ch. Parida
Sri Jogendra Dalai

Personal Assistant

Ms A. Manjula
Ms Singa Soren
Ms Smita Acharya

Skilled Support Staff

Sri Malige Gowda
Sri K. C. Jally
Sri Jairam Das
Sri Sital Ch Haldar
Sri Teegala Muthyullayya
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Sri Trinath Pradhan
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Sri Laxman Bhoi
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Sri A. K. Rout
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Sri Satrughan Bhoi
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Md. Mohibullah
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Sri M. Narasimhaluru
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Sri B. K. Deo
Sri Sarat Ch. Barik
Sri Bhikari Bhoi
Sri Mahendra Behera
Sri Dusmanta Ku Sahu
Sri J. K. Palai
Sri Kalandi Charan Biswal

Staff transferred from Regional Research Centre of CIBA, Puri

Sri P. C. Mohanty, T-2 (Driver)
Sri Bijay Bhoi, SSS
Sri Maharaga Majhi, SSS
Sri Premananda Bisoi, SSS

LIST OF APPROVED ON-GOING PROJECTS

Institute-based projects

Sl. No.	Institute Project Code	Project title	Principal Investigator	Duration
1.	I-54	Diversification in freshwater aquaculture for sustainable production	A. K. Sahu (w.e.f. 5 Oct. 2010	
		p) Captive breeding of stripped snakeheads *Channa striatus* for seed production	Rajesh Kumar	1.4.2011-1.3.2014
2.	I-59	Genetic upgradation of freshwater fish and shellfish	J.K. Sundaray	
		j) Development of parentage analysis system and genomics resource in rohu and *M. rosenbergii*	P. Das	1.4.2011-1.3.2014
		l) Stock evaluation of Catla (*Catla catla*) for establishment of base population and selective breeding of rohu for two traits (growth and disease resistance against aeromoniasis)	K. D. Mahapatra	1.4.2011-1.3.2014
		m) In-vitro production of fertile sperm from the testicular cells of *Clarias batrachus*	H. K. Barman	1.4.2012-31.3.2015
		n) Transcriptomic profiling of the reproduction related tissues during transition from post spawning regression to initiation of gonad activity in rohu (Labeo rohita Ham.)	S. Nandi	1.4.2012-31.3.2015
		o) Proteomic analysis of differentially expressed proteins in giant freshwater prawn, *Macrobrachium rosenbergii* in response to biotic stressors.	J. Mohanty	1.4.2013-31.3.2015
		p) Establishment of base population for genetic improvement of *Labeo bata* (Hamilton, 1822).	P. K. Meher	1.4.2013-31.3.2016
		q) Establishment of base population and stock evaluation of Indian major carp, *Cirrhinus mrigala*.	K. Murmu	1.4.2013-31.3.2016
		r) Development of genomics resources in Indian major carp, *Catla catla*.	Laxman Sahoo	1.4.2013-31.3.2016

3.	I-74	Applied nutrition in freshwater aquaculture	S. S. Giri	1.4.2010-31.3.2013
		d) Assessment of compensatory growth and its associated chemical and biochemical changes in carp due to restricted feeding and re-feeding	K. N. Mohanta	1.4.2011-1.3.2014
4.	I-78	Upscaling of photothermal manipulation technique for off season gonadal maturation in Indian major carp	Ashis Saha	1.4.2011-1.3.2014
5.	I-79	Assessment and development of technological and socio-economic characteristics of freshwater aquaculture options in Gujarat	C. K. Mishra	1.4.2012-31.3.2015
6.	I-80	Sustainable freshwater aquaculture	S.K. Swain	
		a) Breeding and larval rearing of Puntius tambraparniei Silas, 1954 an indigenous ornamental fish from the Western Ghats of India	Rajesh N	1.4.2012-31.3.2015
		b) Germ cell proliferation in deficient gonads after cellular transplantation and maturation in carps.	P. Routray	1.4.2012-31.3.2015
		c) Protocol development for production of stunted carp seed and study of their compensatory growth response in culture system.	P. C. Das	1.4.2012-31.3.2015
		d) Rearing of selected fish species in hi-tech system for enhanced biomass production per unit area	B.C. Mohapatra	1.4.2012-31.3.2015
		e) Productivity evaluation and stock comparison of Indian river prawn, Macrobrachium malcolmsonii (H. Milne Edwards, 1844) from different geographical locations of India.	P. Lalrinsanga	1.4.2012-31.3.2015
		f) Production performance of some high value regionally preferred SIFS in integrated culture system comprising agri-horti-crops and livestocks	P. P. Chakrabarty	1.4.2012-31.3.2015
		g) Water management for sustainable and higher aquaculture production	S. Adhikari	1.4.2012-31.3.2015
		h) Refinement of freshwater pearl culture technology for sustainable production of pearls in confined conditions.	Shailesh Saurabh	1.4.2013-3.1.3.2016
		i) Breeding and culture of tilapia for popularization and brood banking.	P. Routray	1.4.2013-3.1.3.2016
		j) Development of alternate gel based food as a substitute for high value live food.	B. B. Sahoo	1.4.2013-3.1.3.2016
7.	I-81	Evaluation of production performance and quality assessment of carp utilizing certain potential organic wastes	R. N. Mondal	1.4.2012-31.3.2015
8.	I-82	Development of PCR based diagnostics of *Aeromonas hydrophila* infection in freshwater fish species.	M. Samanta	1.4.2012-31.3.2015

9.	I-83	Development of a Database and Information System for Institute's Publications	A. S. Mohapatra	1.4.2012-31.3.2014
10.	I-84	Aquaculture development through participatory approach	G.S. Saha	
		a) Mainstreaming gender concerns in freshwater aquaculture development-An action research	P. Jayasankar	1.4.2012-31.3.2015
		b) Development of Ornamental fish village, Landijhari and Sarauli in Deogarh district of Odisha	S. K. Swain	1.4.2012-31.3.2015
		c) Impact Pathways and Assessment of CIFA Technologies viz., Immunoboost C and CIFAX: An End Users Perspective.	P. Ananth	1.4.2013-31.3.2016
		d) Impact assessment of cat fish & Murrel aquaculture in India.	N. K. Barik	1.4.2013-31.3.2016
		e) Study of Dynamics of Aquaculture field schools.	G.S. Saha	1.4.2013-31.3.2015
11.	I-85	Feed and Nutrient evaluation in cultivable freshwater fish.	S. S. Giri	
		a) Status and impact of antioxidants in fish feeds.	S. Toppo	1.4.2013-31.3.2016
		b) Macronutrients requirement of the Peninsular carp Puntius carnaticus fingerlings.	N. Sridhar	1.4.2013-31.3.206
		c) Improving the protein efficiency in fish diet.	K.N. Mohanta	1.4.2013-31.3.2016
		d) Detoxification and use of plant based non-conventional ingredients in carp feeds.	S.C. Rath	1.4.2013-31.3.2016
		e) Effect of some processing conditions on quality of extruded floating feed for Indian major carps.	K.C. Das	1.4.2013-31.3.2016
12.	I-86	Species Diversification in Aquaculture: Development of Sustainable Practices for Introduction of Peninsular Fishes in Culture Systems	N. Sridhar	
		a) Brood stock development, breeding and larval rearing of Puntius carnaticus, and P. pulchellus	N. Sridhar	1.4.2013-31.3.2016
		b) Enhancement of maturation through feeding and hormonal inputs in the peninsular carp Puntius pulchellus.	B. Gangadhar	1.4.2013-31.3.2016
		c) Value added products from medium and small indigenous fish species.	M. R. Raghunath	1.4.2013-31.3.2014
		d) Studies on Argulus infection pattern in peninsular carps subsequent up on their introduction to culture systems with an aim on development of prophylactic and control measures.	Hemaprasanth	1.4.2013-31.3.2016
13.	I-87	Tribal Sub-Plan (TSP) project	B. C. Mohapatra	1.4.2013-31.3.2016

Externally funded projects

Sl. No.	Project code	Title	Funding Agency	Pr. Investigator	Duration
1.	E-01	Biotechnology information system on aquaculture	Department of Biotechnology, Govt. of India	A. S. Mahapatra	1991 – till date
2.	E-03	Application of plastics in agriculture - plant environment control and agricultural processing (ICAR)	AICRP, ICAR	B. C. Mohapatra	Continuous
3.	E-40	Genetic improvement of freshwater prawn *Macrobrachium rosenbergii* (de man) in India (Phase-II)	World Fish Centre	Bindu R. Pillai	Oct. 2010 – Dec. 2013
4.	E-49	Application of micro-organism in agriculture in allied sectors (AMSS) *Theme: Microbial diversity and identification: isolation and characterization of microbes from freshwater ecosystem (Component-1)*	NBAIM, ICAR	N. K. Maiti	2006- March, 2014
5.	E-50	Development of a library of putative probionts from marine/ freshwater environment belonging to the genus *Pseudomonas, Micrococcus* and *Bacillus* for application in mariculture/freshwater aquaculture system (Component-2)	NBAIM, ICAR	S. Mohanty	April 2008- March, 2014
6.	E-52	A value chain in murrel production in Tamil Nadu and Orissa (Component-2)	NAIP	Rajesh Kumar	July 2008 – March, 2014
7.	E-53	Toll-like receptors in phylogenetically divergent fish species their contribution in modulating the innate immunity (Component-4)	NAIP	M. Samanta	Jan 2009 – March 2014
8.	E-54	Sustainable livelihood improvement through integrated freshwater aquaculture, horticulture and livestock development in Mayurbhanj, Keonjhar and Sambalpur districts of Orissa (Component –3)	NAIP	S. K. Swain	April 2009- March, 2014
9.	E- 58	Bioprospecting of genes and allele mining for abiotic stress	NAIP	N.K.Maiti	June 2009- March 2014
10.	E-61	Intellectual Property Management and Transfer / Commercialization of Agricultural Technology	ICAR XIth Five Year Plan Scheme	P. Swain	2007-2014
11.	E-67	Development of captive broodstock bank of giant freshwater prawn, *M.rosenbergii (scampi)* at Instructional freshwater fish farm, CoFc, Nellore, Andhra Pradesh	National Fisheries Development Board, Hyderabad	B. R. Pillai	December 2010- March, 2014
12.	E-68	Establishment of hatchery and seed production facilities of *Pangasianodon hypophthalmus* (striped catfish in Andhra Pradesh)	National Fisheries Development Board, Hyderabad	B. S. Giri	February, 2011- January, 2016

13.	E-70	The nature of impact of abiotic stresses on three diverse freshwater species of fishes	National fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA)	M. Samanta	January 2011 – January, 2014
14.	E-71	Development of novel immunopotentiator molecules from fish host and pathogens for broad spectrum disease control in freshwater aquaculture	ICAR National Fellow Scheme	P. K. Sahoo	8 April, 2011 – March, 2016
15.	E-72	Nanotechnology in aquaculture: An alternative approach for fish health management and water remediation	ICAR National Fellow Scheme	P. Swain	8 April, 2011 – March, 2016
16.	E-73	Improvement of culture conditions, characterization and elucidating underling Oct4 mediated networking pathways for spermatogonial stem cells of *Labeo rohita*	Dept. of Biotechnology, Govt. of India	H. K. Barman	September 2011-September 2014
17.	E-74	Development of molecular marker-based seed identification system of cultured carps (Cyprinidae)	DST, Govt. of India	P. Jayasankar	September 2011-September 2014
18.	E-75	Production of antiviral Mx protein in carps	Dept. of Biotechnology, Govt. of India	B. K. Das	September 2011-August 2014
19.	E-76	Molecular characterization of gonadotropin and gonadotropin receptors and their regulations during photothermal manipulation of reproduction in rohu (*L. rohita*)	Science and Engineering Research Board (SERB)	Ashis Saha	April, 2012 – March, 2015
20.	E-77	Development of a protocol for targeted integration of genes in Catla (*Catla catla*)	National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA)	H. K. Barman	June, 2012 – May 2015
21.	E-78	Stock characterization, captive breeding, seed production and culture of hilsa (*Tenualosa ilisha*)	National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA)	D. N. Chattopadhyay	1 Nov 2012 – 30 Nov, 2017
22.	E-79	Periphyton enhancement – a sustainable technology for efficient nutrient utuilisation in seed rearing and grow-out culture of carps with special reference to the peninsular carp Labeo fimbriatus	DBT, Ministry of Science and Technology, Govt. of India	G. Barlaya	September 2012 – August, 2015
23.	E-80	Stock improvement and quality seed production of important freshwater carps, catfish and prawn: prerequisite for NFFBB	NFDB	K. D. Mahapatra	February, 2013 – February 2018

24.	E-81	Regulation of Kisspeptin and GnRH during reproduction in Labeo rohita under varied environmental condition (RGYI)	DBT, Ministry of Science and Technology, Govt. of India	Ashis Saha	January 2013 – January 2016
25.	E-82	Business planning and development centre for aqua-entrepreneurship	NAIP	N. K. Barik	2013-2017
26.	E-83	Diversity and synthesis of immunoglobulin in the Indian major carps	NFBSFARA	M. Samanta	April 2013 March 2017
27.	E-84	Strengthening of Digital Library & Information Management under NARS (e-GRANTH)	NAIP	A. S. Mahapatra	July 2013 March 2014
28.	E-85	Whole Genome Sequencing and development of allied genomic resources in two commercially important fish Labeo rohita and Clarias batrachus.	Department of Biotechnology, Govt. of India	P. Das	September 2013- September 2016
29.	E-86	National Surveillance programme on Aquatic animal diseases	NFDB-NBFGR	P. K Sahoo	2013-2018
30.	E-87	Joint Implementation of Agricultural Livelihood Support Services (ALSS) Component of OCTMP in Khordha district	Orissa Community Tank Management Project	P. N. Ananth	2013-2014

Women in Aquaculture

कार्यकारी सारांश

1. संस्थान का नाम व पता : केन्द्रीय मीठाजल जीवपालन अनुसंधान संस्थान
कौशल्यागंग, भुवनेश्वर-751002,
ओडीशा

क. मुख्य परिसर : कौशल्यागंग,भुवनेश्वर-751002, ओडीशा

ख. क्षेत्रीय केन्द्र :

i) **क्षेत्रीय अनुसंधान केन्द्र**
रहरा-743186,(प.ब)
क्षेत्रीय अनुसंधान केन्द्र, बी 11/207,
कल्यानी-741235,(प.ब.)

ii) **क्षेत्रीय अनुसंधान केन्द्र**
हेसरघाटा लेक, बंगलौर-430081,(कर्नाटक)

iii) **क्षेत्रीय अनुसंधान केन्द्र**
पेनामलरू, विजयवाड़ा-521131,(आ.प्र.)

iv) **क्षेत्रीय अनुसंधान केन्द्र**
एटीक, आनन्द कृषि विश्वविद्यालय
बोरसाद चौकड़ी, आनन्द, 388001,
गुजरात

ग. के.वी.के : **कृषि विज्ञान केन्द्र**
कौशल्यागंग, भुवनेश्वर-751002,(ओडीशा)

2. बजट (2013-14)

ए. संस्थागत (रू.लाख में)

योजनागत		गैर -योजनागत					
प्रावधान	व्यय	सरकारी अनुदान	आंतरिक आबंटन + परिषद सेयर से मुख्यालय द्वारा प्रदान अतिरिक्त राशि	कुल आबंटन (कॉलम 3+4)	सरकारी अनुदान से कुल व्यय	राजश्व प्राप्ति से कुल व्यय	कुल व्यय (कॉलम 6+7)
1	2	3	4	5	6	7	8
744.00	741.70	2197.94	149.11	2347.05	2105.18	149.11	2254.29

बी. वाह्य श्रोत (रू.लाख में)

स्त्रोत	धनराशि
बी.टी.आई.एस.	0.39
पेंसन और अन्य सेवानिवृत लाभ	129.01
भा.कृ.अनु.प./ए.पी.ए/आईपीआर/एन एफ बी एस एप ए आर ए/के.वी.के/एन. ए. आई. पी. (योजनागत)	638.06
गैर योजनागत	63.93
निजी ऋण और अग्रिम राशि	10.77
बाह्य वित्त पोषित परियोजनांए	29.04
कुल	**871.20**

सी. राजस्व प्राप्ति (2012-13) (रू.लाख में)

श्रोत	राशि
प्रक्षेत्र उत्पाद	5.54
मत्स्य एवं मुर्गी विक्रय	12.83
वाहन/अन्य मशीन सामग्री विक्रय	2.21
प्रकाशन विक्रय	0.13
लाइसेन्स शुल्क/जल मुल्य	5.60
परीक्षण विश्लेषण शुल्क	0.28
निविदा फार्म मूल्य	1.25
सेवा प्रदान	4.93
प्रशिक्षण	7.03
विविध	5.56
ऋण एवं अग्रिम राशि पर ब्याज	16.65
टी.डी. आर. पर व्याज	27.80
अन्य (रॉयल्टी और संस्थान शुल्क)	0.36
कुल	90.17

3. कर्मचारियों की संख्या (31.3.2014 तक)

श्रेणी	मंजूरी	स्थिति	रिक्त
वैज्ञानिक			
निदेशक	1	1	-
विभागाध्यक्ष	4	3	1
प्रधान वैज्ञानिक	2	-	2
वरिष्ठ वैज्ञानिक	12	10	2
वैज्ञानिक	60	40	20
कुल	**79**	**54**	**25**
श्रेणी (तकनीकी)			
टी-6	3+1	0	3+1
टी-3	23	14	9
टी-2	3	3	0
टी-1(वाहन चालक सहित)	21	17	4
कुल	**51**	**34**	**17**
श्रेणी (प्रशासनिक)			
वरिष्ठ प्रशासनिक अधिकारी	1	-	1
प्रशासनिक अधिकारी	1	1	-
वित्त एवं लेखा अधिकारी	1	1	-
सहायक वित्त एवं लेखा अधिकारी	5	3	2
सहायक प्रशासनिक अधिकारी	1	1	-
सुरक्षा अधिकारी	1	1	-
निजी सचिव	1	1	-
व्यक्तिगत सहायक	3	3	-
सहायक	10	6	4
वरिष्ठ लिपिक	6	6	-
कनिष्ठ आशुलिपिक	1	-	1
कनिष्ठ लिपिक	6	3	3
कुल	**37**	**25**	**12**
सहायक			
कुशल सहायक कर्मचारी	120	91	29
कुल	**287**	**204**	**83**

कृषि विज्ञान केन्द्र में कर्मचारियों की संख्या (31.3.2014 तक)

श्रेणी	मंजूरी	स्थिति	रिक्त
वैज्ञानिक			
कार्यक्रम संचालक	1	1	-
तकनीकी			
विषय वस्तु विशेषज्ञ	6	4	2
कार्यक्रम सहायक	3	2	1
टी-1 (वाहन चालक)	2	2	-
प्रशासनिक			
सहायक	1	-	1
कनिष्ठ आशुलिपिक	1	-	1
सहायक			
कुशल सहायक कर्मचारी	2	2	-
कुल	**16**	**11**	**5**

4. अनुसंधान परियोजनांए

(क) संस्थान अधारित : 13

(ख) बाह्य वित्त पोषित : 30

5. प्रशिक्षण कार्यक्रम आयोजित

स्तर	कार्यक्रमों की संख्या	प्रतिभागियों की संख्या
राष्ट्रीय	20	597
अंतर्राष्ट्रीय	-	-

6. मानव संसाधन विकास

(क) राष्ट्रीय स्तर पर प्रशिक्षत व्यक्तियों की संख्या : 13

(ख) अंतर्राष्ट्रीय स्तर पर प्रशिक्षत व्यक्तियों की संख्या : 02

7. कार्यशालाओं का आयोजन

राष्ट्रीय : 5

अंतर्राष्ट्रीय : 1

8. संगोष्ठियों/सेमिनार /कार्यशालाओं आदि में भागिदारी

स्तर	प्रतिभागियों की संख्या
राष्ट्रीय	46
अंतर्राष्ट्रीय	03

9. ढाँचागत विकास

- सीफा कौशल्यागंग में वीजी झिंगरण सभागार का जीर्णोधार
- सीफा कौशल्यागंग में चारदिवारी का निर्माण
- सीफा कौशल्यागंग में 80,000 गैलन क्षमता का ओवरहेड टैंक का जीर्णोधार
- सीफा कौशल्यागंग में टाइप III और टाइप IV आवासीय क्वार्टर का जीर्णोधार
- नई बीपीडी, सीफा कार्यालय का निर्माण
- बीपीडी, सीफा के तहत तकनीकी पार्क का निर्माण
- बीपीडी, सीफा के तहत तीलापिया हैचरी का निर्माण
- बीपीडी, सीफा के तहत तीन तालाबों का निर्माण

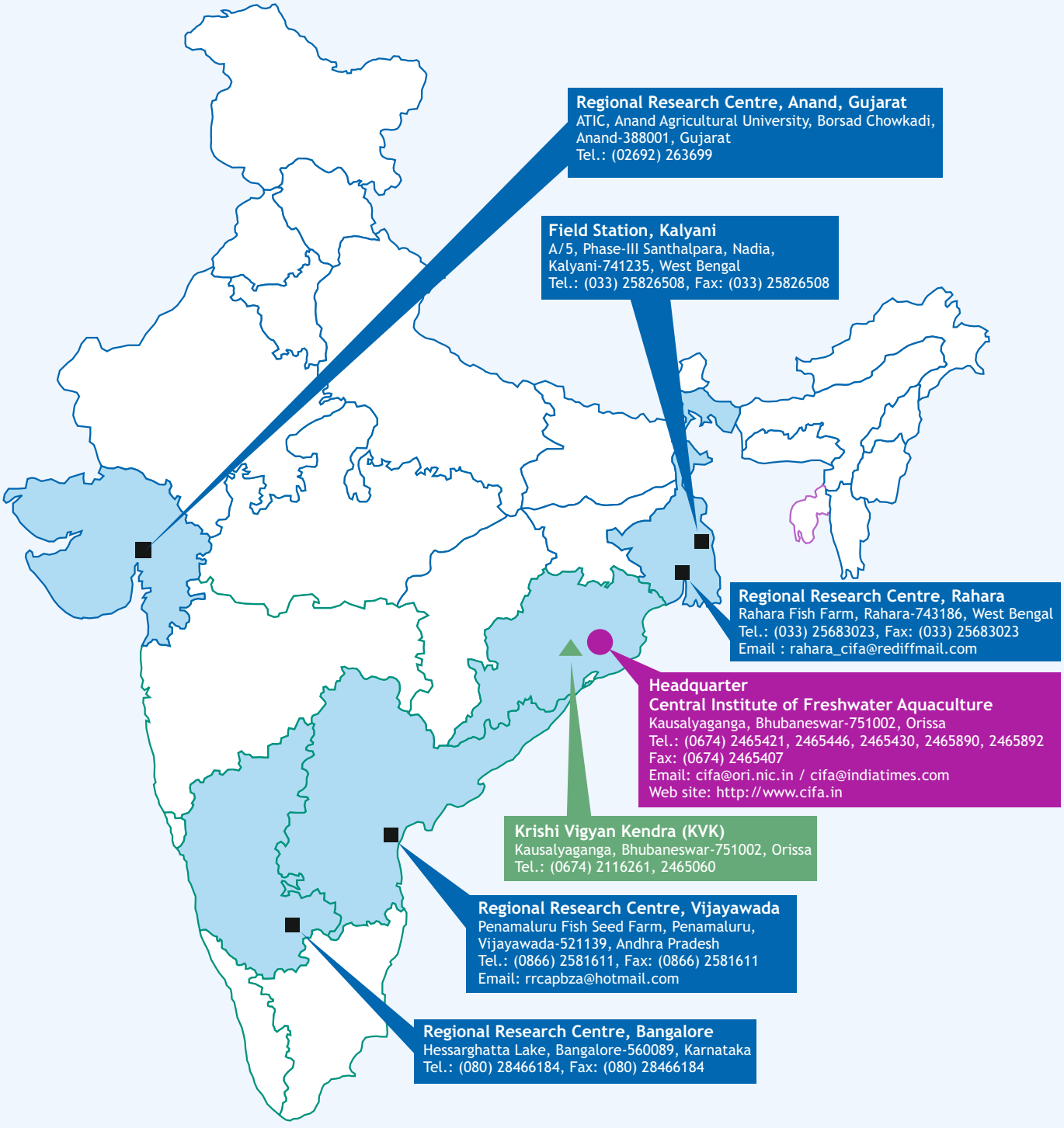
10. Salient Research Achievements

- जनन कोशिका प्राप्तकर्ता मछली और एक सामान्य मछली के गैमीट का उपयोग करके सफलतापूर्वक 40% सरोगेट कार्प का उत्पादन किया गया ।
- उचित आहार और निवास-स्थान प्रबंधन की मदद से कंक्रीट सिस्टर्न में स्ट्रीप्ड स्नेकहेड (चन्ना स्ट्रेटस) प्रजनक मछलियों को विकसित किया गया। एचसीजी एवं पीजी घोल के साथ मछलियों का उत्प्रेरित कैप्टिव प्रजनन किया गया और निषेचन एवं हैचिंग दर क्रमश: 80-99% और 75-90%, प्राप्त किया।
- हैचरी में डावकिनसिया टामब्रापारनेई का सफलतापूर्वक प्रजनन किया गया एवं उनके आहार में जीवित फीड के समावेश के साथ लार्वल संवर्धन किया गया।
- शोध के परिणाम से पता चला कि रोहू में बीज स्टंटीग के घनत्व और अवधि का एकल पालन के साथ साथ बहु पालन दोनों में बाद के क्रम में ग्रो-आउट संवर्धन में किसी भी प्रतिपूरक वृद्धि का पता नही चला।

- अध्ययन ने दर्शाया कि साईलो के उंचाई की वृद्धि के साथ तिलापिया (ओरीओक्रोमिस निलोटिकस) की वृद्धि एवं प्रति घन मीटर बायोमास उत्पादन में कमी पाया गया।
- जल बदलाव प्रणाली तकनीक के साथ परंपरागत साफ पानी तकनीक को अपनाकर 20 पीपीटी खारा जल में मैक्रोब्रेकियम मालकमसोनी के प्रजनन एवं लार्वल संवर्धन का संचालन सफलतापूर्वक आयोजित किया गया।
- तिलापिया प्रजनन एवं नश्ल विकास कार्यक्रम को शुरु किया गया और एकल लिंग में 3.2 टन/हे./6 महीने में और मिश्रित लिंग संवर्धन में 2.29 टन/हे./6 महीने में कुल उत्पादन प्राप्त किया गया।
- सीफा के कल्याणी फील्ड स्टेशन में हाइपोफाइजेसन के माध्यम से मिस्टस गुलिओ का सफलतापूर्वक उत्प्रेरित प्रजनन किया गया।
- एनएफडीबी कार्यक्रम के तहत स्ट्रीप्ड कैटफिश पंगासिएनडॉन हाइपोथेलमस का लगभग 20 लाख स्पॉन का उत्पादन किया गया।
- मात्स्यिकी कॉलेज प्रक्षेत्र, नैलुर में मैक्रोब्रेकियम रोजेनबर्गी ब्रुड बैंक को स्थापित किया गया और बीज उत्पादन के लिए उपयुक्त प्रजनक स्टॉक झींगा संवर्धन के लिए तकनीकी का मार्गदर्शन प्रदान किया गया।
- गोदाखली में हुगली नदी से एकत्रित हिलसा का ड्राई स्ट्रिपिंग विधि के द्वारा सफलतापूर्वक प्रजनन कराया गया।
- राष्ट्रीय स्वच्छता फांउडेशन जल गुणवत्ता सूचंकाक (एनएसफ डब्लूक्युआई) पर आधारित पंगस संवर्धन तालाबों से जलकृषि अपशिष्टों के लिए जल गुणवत्ता सूचकांक को तैयार किया गया।
- अध्ययन से पता चला कि जल में फॉस्फोरस मात्रा को कम करने में चूने की तुलना में जिप्सम अधिक प्रभावी पाया गया।
- कम लागत स्वदेशी मीठाजल मोती सीपी धारक को डिजाइन करने में सफलता प्राप्त किया गया।
- मैक्रोब्रेकियम रोजेनबर्गी लार्वा के लिए उच्च मुल्य की जीवित खाद्य हेतु एक विकल्प के रुप में वैकल्पिक जेल आधारित खाद्य विकसित किया गया।
- तुलसी मैरी, एक आदिवासी महिला द्वारा चलाई जाने वाली सजावटी मछलियों की आसान व्यापार के लिए सीमेंट टैंक और पालतू जानवरों की दुकान के साथ विपणन केंद्र बारकोट में स्थापित किया गया।
- बाली में एफआरपी कार्प हैचरी को स्थापित एवं संचालित किया गया और एक संचालन में कार्प का 4.0 लाख स्पॉन का उत्पादन किया गया। इसके अलावा 0.8 टन/ हेक्टेयर/ वर्ष उत्पादन की वेंच मार्क की तुलना में 3.8 टन/हेक्टेयर/वर्ष प्राप्त किया। आदिवासी क्षेत्र में आजीविका सहायता कार्यक्रम के सफल, बॉली मॉडल ने लोगो का काफी ध्यान आकर्षित किया है।
- ओडिशा के चार प्रक्षेत्रों में चुनिंदा प्रजनित मेक्रोब्रेंकियम रोजेनबर्गी के चार पीढ़ी का फार्म परीक्षण किया गया। चुनिंदा प्रजनित मेक्रोब्रेंकियम रोजेनबर्गी के 5वीं पीढ़ी (जी 5) का भी उत्पादन किया गया।
- लगभग 2.0 टन/हे./वर्ष के औसत उत्पादन के साथ ओडिशा के खुर्दा और नयागढ़ जिलों में मरैल ग्रो-आउट खेती का प्रदर्शन किया गया।
- एकीकृत मीठाजल कृषि, बागवानी और पशुधन विकास के माध्यम से टिकाऊ आजीविका सुधार पर एनएआईपी परियोजना के तहत लगभग 4395 कृषक लाभान्वित हुए।
- मछली के लिए पॉली-टेंट ड्रायर मशीन का डिजाइन और विकास किया गया।
- कल्याणी फील्ड स्टेसन में मछली के साथ उच्च मूल्य की फसलों (बेबी कार्न, सूरजमुखी, गर्म मौसम टमाटर)के साथ एकीकृत खेती मॉडल को विकसित किया गया।
- मध्यम और लघु स्वदेशी मत्स्य प्रजातियों से मूल्य वर्धित उत्पाद फीश क्रेकर को विकसित किया गया।
- लेबिओ फिमब्रिएटस फ्राई, फिंगरलिंग और व्यस्क मछलियों में आरगुलस की संवेदनशीलता का मुल्यांकन से पता चला कि 1800 मेटान्युप्लाई/मछली तक के साथ चुनौती बर्दाश्त किया और 2000 मेटान्युप्लाई/मछली का संक्रामक खुराक घातक पाया गया।
- डेल्टा - फैटी एसाइल डीसाचुरेज के आणविक लक्षण और अभिव्यक्ति विश्लेषण को मीठाजल कार्प, पुन्टीयस गोनिओनोटस में पता लगाया गया।
- एसेम्बली के बाद कतला जीनोम के एक हिस्से की अगली पीढ़ी से लगभग 5.7 एमबी अनुक्रम डेटा और कोंटिग्स उत्पन्न किया।

- पीओयु२ जीन का क्लोनिंग और लक्षण वर्णन प्रक्षेत्र रोहू, लेबिओ रोहिता में किया गया। शुरुआत में लेबिओं रोहिता में विकसित 300 मोनोमोर्फिक माइक्रोसेटेलाइट मार्करों में से 20 मार्कर कतला कतला, सिरहिनस मृगला, लेबिओ फिमब्रेटस, लेबिओ बाटा, सिरहनस रेबा एवं लेबिओ गोनियस में मोनोमोर्फिक पाया गया।
- शोध से पुन्टीयस कारनाटीकस फिंगरलिंग के लिए 35% क्रुड प्रोटीन आहार की पर्याप्तता का पता चला।
- 10% से कम कच्चे टीओसी का समावेश से रोहू फिंगरलिंग के वृद्धि और उत्तरजीवित्ता पर कोई प्रतिकूल प्रभाव नही पड़ा।
- 130 या 150 डिग्री सेल्सियस तापक्रम और 20 से 22 प्रतिशत नमी स्तर को बरकरार रखते हुए खाद्य सामग्री से उत्तम गुणवत्ता फ्लोटिंग फिड को तैयार किया जा सकता है।
- स्तनधारियों में प्रजनन की प्रमुख मॉडुलेटर दो केआईएसएस जीन को लेबिओं रोहिता में लक्षण वर्णन किया गया।
- अध्ययन ने दर्शाया है कि बायोफ्लेक के उपयोग के बाद ८ दिनों में एक्रोमोबेक्टर जाइलोसोक्सीडेस 80 µg / लिटर अमोनिया को निकालता है और 12 दिनों मे ई. क्लोएसि 90 µg/ लिटर अमोनिया को निकाल सकता है।
- शोध से पता चला कि रोहू टीएलआर 22 कॉमन कार्प टीएलआर 22 से निकटतम संबधित था।
- सहज प्रतिरक्षा रिसेप्टर्स (एनएलआरसी5, एनएलआरएक्स 1, टीएलआर 5 और टीएलआर 22) और उनके डाउनस्ट्रीम अणुओं (आईआरएके 4, टीआरएएफ 4 और आइआरएफ 3) की अभिव्यक्ति पैटर्न गर्मी और ठंडा तनाव जैसे अजैविक तनावों के जवाब में मांगुर में स्पष्ट किया गया।
- बाह्य परजीवी ए. सियामेनसिस और मेजबान एल.रोहिता के पीओ प्रोटीन का पूर्ण सिक्वेंस की जानकारी प्राप्त किया गया जो ए. सियामेनसिस के खिलाफ रक्षात्मक प्रतिरक्षा में भूमिका हो सकता है।
- कॉपर ऑक्साइड नैनोपर्टिकल, जल की माइक्रोबियल लोड के साथ साथ अमोनिया की मात्रा को कम करते पाया गया।
- रोहू, कतला और मृगल में इन-विवो में एमएक्स अभिव्यक्ति को पुरा किया गया।
- एरोमोनास हाइड्रोफिला के विषैलापन जुड़े जीन (एइरोलाइसिन, हेमोलाइसिन, जीसीएटी, लाइपेज, सेरिन प्रोटीएज, ओएमपी, एसीटी, इलासटेज, गाइरेज-बी) को एम्पीलिफाई करने के लिए पीसीआर प्राइमर को डिजाइन किया गया।
- रोहू में इम्युनोग्लोबुलिन एम, बी-सेल सक्रिय फेक्टर और सीड 22 जीनों को आंशिक रुप से क्लोन और सिक्वेंस किया गया।
- जलीय जीवों के रोगों पर राष्ट्रीय निगरानी कार्यक्रम को ओडिशा और आंध्र प्रदेश में चालु किया गया और देखा गया कि आरगुलोसिस और बैक्टेरियल सेपटिसेइमिया जैसे परजीवी कृषक तालाबों में अधिक पाये जाते हैं।
- संस्थान आधारित प्रकाशनो के विभिन्न प्रकार को इकेक्ट्रोनिक प्रारुप में परिवर्तित कर संस्थान आधारित प्रकाशनो का डिजिटल संग्रहन किया गया और इन्हे डाटाबेस में भंडारण किया गया।
- ज्ञान प्रसार कार्यक्रम के लिए कार्प आहार पर ई-लर्निंग जो मत्स्य आहारों पर जानकारी और किसानों के प्रश्नो के उत्तर को देने के लिए विकसित किया गया।
- जलकृषि हस्तक्षेप के माध्यम से सामाजिक आर्थिक विकास और महिलाओं के सशक्तिकरण ने 2013-2014 के दौरान 41,000 रुपये के शुद्द आय का उत्पादन किया जो पुरी और खोर्द्धा जिलों के चयनित गावों के लगभग १०० महिला लाभार्थी के आजिविका और पोषण सुरक्षा में योगदान दिया।
- ओपन सोर्स लाइब्रेरी ऑटोमेशन प्रबंधन सॉफ्टवेयर कोहा को डेबियन लिनक्स सर्वर पर सीफा में स्थापित किया गया।
- व्यापार योजना एवं विकास (बीपीडी) इकाई को सीफा में जून, 2013 में स्थापित किया गया और इनकुबेसन सेवाओं और परामर्श के माध्यम से लगभग 9.0 लाख रुपये का राजस्व उत्पन्न किया गया।
- ऑनलाइन एएसआरबी परीक्षा प्रणाली केन्द्र अब पूरी तरह चालू है और 55 विषयों से लगभग 483 उम्मिदवारों ने परीक्षा लिखा। न्दो लाभर्थियों के साथ गुजरात के आनंद और खेड़ा जिलों में फ्राई (1.57 लाख) से फिंगरलिंग कार्प बीज संवर्धन पर प्रदर्शन किया गया और 68% उत्तरजीवित्ता प्राप्त किया।

RESEARCH LOCATION



Regional Research Centre, Anand, Gujarat
ATIC, Anand Agricultural University, Borsad Chowkadi,
Anand-388001, Gujarat
Tel.: (02692) 263699

Field Station, Kalyani
A/5, Phase-III Santhalpara, Nadia,
Kalyani-741235, West Bengal
Tel.: (033) 25826508, Fax: (033) 25826508

Regional Research Centre, Rahara
Rahara Fish Farm, Rahara-743186, West Bengal
Tel.: (033) 25683023, Fax: (033) 25683023
Email : rahara_cifa@rediffmail.com

Headquarter
Central Institute of Freshwater Aquaculture
Kausalyaganga, Bhubaneswar-751002, Orissa
Tel.: (0674) 2465421, 2465446, 2465430, 2465890, 2465892
Fax: (0674) 2465407
Email: cifa@ori.nic.in / cifa@indiatimes.com
Web site: http://www.cifa.in

Krishi Vigyan Kendra (KVK)
Kausalyaganga, Bhubaneswar-751002, Orissa
Tel.: (0674) 2116261, 2465060

Regional Research Centre, Vijayawada
Penamaluru Fish Seed Farm, Penamaluru,
Vijayawada-521139, Andhra Pradesh
Tel.: (0866) 2581611, Fax: (0866) 2581611
Email: rrcapbza@hotmail.com

Regional Research Centre, Bangalore
Hessarghatta Lake, Bangalore-560089, Karnataka
Tel.: (080) 28466184, Fax: (080) 28466184

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An Approach Towards "Farmers First"

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ISSN : 0972-012X

CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE
(An ISO 9001:2008 Certified Institution)
(Indian Council of Agricultural Research)
Kausalyaganga, Bhubaneswar-751 002, Odisha, India
Email : cifa@cifamail.in, cifa@ori.nic.in
www.cifa.in