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ICAR

ICAR-CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE

(An ISO 9001:2008 Certified Institution)

CIFA

ANNUAL REPORT 2014-15

ICAR CIFA ANNUAL REPORT 2014-15

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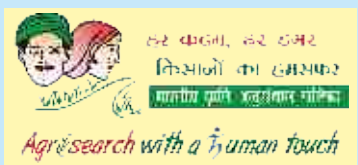

CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE
(An ISO 9001:2008 Certified Institution)
(Indian Council of Agricultural Research)
KAUSALYAGANGA, BHUBANESWAR 751 002, ODISHA, INDIA

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PREFACE

The inaugural speech given by Hon'ble PM Shri Narendra Modi*ji* during the 86th Foundation day and annual award function of ICAR at Delhi was thought provoking and farmer-centric, and the key points of his address were need for effective lab to land programme, progressive farmers, water conservation, Indian herbal medicines and also BLUE REVOLUTION. He had a word of praise for fisheries sector and mentioned about its high potential in improving our food and nutritional security and foreign exchange earnings through higher production of sea foods. His remarks had instantaneously touched the chord of our fisheries policy makers. Fishery Science SMD has already instructed fisheries institutes to have research and development programmes in key areas. With reference to freshwater aquaculture, good quality seed and feed production, region specific productivity of Pangas, diversification of species, etc. are highlighted and at ICAR-CIFA we have already identified nodal officers who would report monthly progress in these critical areas.

Application of space technology, e-governance, greater linkages with state and central institutions, better communication facilities and wider reach of our technologies to the farmers are among top priorities of ICAR-CIFA in the coming years. Standing Financial Committee (SFC) document of the institute is approved by the Planning commission and the onus is on us to implement the programmes with great speed and vigour in the remaining two years.

As a part of the Odisha monsoon contingency plan our scientists have been visiting 5 districts, including Bolangir, Ganjam, Keonjar, Nayagarh and Sambalpur and collected detailed information on agriculture crops, soil and water characteristics, rainfall trend during the entire year. They had extensive discussions with district officials including collector, KVK staff and state fisheries officers. The institute has transferred seeds of aeromoniasis resistant selectively bred rohu to the Vijayawada RRC for on farm trials with a view to releasing the same to the farmers. The new entrant to the genetically improved stocks, catla, has completed its first generation of selection. Catla was also induced to breed during January through photothermal manipulation. Research on argulosis and disease surveillance has been prioritized. Our new 'wealth from waste products', CIFA-Fish Planktofert & CIFA-Fish Biofert attracted attention of the participants during 86th AGM of the ICAR. Hands on training on post-harvest value addition in freshwater aquaculture was imparted to women SHGs.

One of the “Land to lab” projects attempted by us, culture using 'stunted' fingerlings of carp as is practiced in Andhra and few other states, has yielded interesting result – stunting carp fingerlings beyond 4 months do not lead to any significant compensatory growth during the grow out period. Going by this it may be deduced that the 'yearlings' and 'zero point' will not have compensatory growth benefits, though the practice ensures year round availability of fingerlings for stocking. Production of surrogate carp has reached a decisively encouraging stage. It is heartening to mention that for the first time our scientists have field demonstrated the genetically improved rohu *Jayanti* in Gujarat, and quite encouraging results were obtained. Our third Aqua Field School was launched in Durg, Chhattisgarh. For the first time, early and repeated breeding of silver barb was achieved using diet CIFABROOD™ and produced 12 million spawn of silver barb by a commercial operator in West Bengal. One important researchable topic emerged out was the need to develop suitable broodstock diet for male carp – the current CIFABROOD™ favours only early maturation of female fish. Indian

army-sponsored training for tribals from Assam on freshwater aquaculture conducted under the TSP programme at Bhubaneswar was a notable event of the reporting period. These hapless tribals are often caught in cross fire between militants and government forces; the skill development in aquaculture imparted to them would go a long way for their rehabilitation and economic support. ICAR-CIFA has signaled its entry to e-Governance by implementing Management Information System (MIS) including Financial Management System (FMS).

Species diversification is one of the important strategies for vertical increase in productivity. ICAR-CIFA has successfully introduced one more species, *Osteobrama belangeri*, the state fish of Manipur into its kitty. The institute is absolutely ready with breeding practice of *Channa striatus*. Analogous to Air Quality Index, which our present Union Government has implemented in some of the metropolitan states, ICAR-CIFA has initiated implementing Water Quality Index (WQI) with a view to classifying water bodies suitable for freshwater aquaculture. The institute has also done water budgeting of carp culture ponds in Andhra Pradesh, West Bengal and Odisha. We were fortunate to have Dr. Z. John Liu, Professor, Auburn University, AL, USA to lead the first International Consultation on Fish Genomics organized by the institute. The consultation meet raised many issues related to developing a roadmap for application of genomics in genetic improvement programmes. Marker assisted breeding, whole genome sequencing, phenomics, development of phenotypic and ontology databases and genomic selection in aquaculture were identified as the critical areas in which ICAR and other organizations like Auburn University, USA should have collaborative and network programmes. The institute has begun to establish in the genomics era, signaling high throughput genome wide marker discovery in carp and giant freshwater prawn. and whole genome sequencing of rohu using Next Gen approaches. In collaboration with World Health Organization (WHO) we had organized the Third Pilot session of 'Five Keys to Safer Aquaculture Products to Protect Public Health' with a view to helping the small scale aquaculture producers raise safe and nutritious fish for themselves, their families and for sale in local market. The program was aimed at developing awareness about hygiene, food borne diseases, safe handling of fish to ensure sustainability of safe and nutritious locally grown food produced by small and marginal aquaculture farmers. ICAR-CIFA is on the anvil of nurturing strong linkage with other member countries of NACA.

A new initiative, Know Your Farmer (KYF) programme was conducted in West Bengal, Jharkhand, Assam and Tripura by a group of 8 new ARS recruits of the institute, which has brought in useful information on famers' problems, requirements, aspirations and expectations from research institutes like ICAR-CIFA. "Young Turks" comprising of 13 new ARS probationers have joined our institute; they are freshers, and we are bound to harness their talents and new thinking in shaping our future.

Fisheries and aquaculture fraternity had lost two greats during the reporting year – Dr Hiralal Chaudhuri, who was instrumental in introducing induced breeding of fish for the first time in India and the occasion is remembered every year on July 10 when we observe National Fish Farmers' Day. We also had lost Dr S.A.H. Abidi, another doyen in fisheries research and education. I join the ICAR-CIFA *parivar* in offering our fond remembrances and respect to these departed souls. Deep condolences to those staff members who were in active service, as well as superannuated. Let me place on record my compliments to the colleagues who have won scientific achievement awards.

The editorial committee comprising of Dr. S.K. Swain, Dr. J.K. Sundaray, Dr. S. Adhikari, Dr. B.K. Das, Dr. K.N. Mohanta, Dr. Shailesh Saurabh, Dr. Rajesh Kumar, Shri I. Sivaraman and Dr. D.K. Verma have done commendable job to bring out the Annual Report on time. Mrs. Dhir and Shri S. Mahali have supported well. We are grateful to Dr. S. Ayyappan, Secretary, DARE and DG, ICAR, Dr. 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 our farmer-oriented research, extension, training and consultancy programmes for the sustainable development of freshwater aquaculture in the country.

Dr P. Jayasankar
Director

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Kausalyaganga,Bhubaneswar-751002
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ICAR-CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE
(Indian Council Of Agricultural Research)
Kausalyaganga,Bhubaneswar-751002
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DIRECTOR : P. JAYASANKAR, Ph.D
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FISH NUTRITION AND PHYSIOLOGY
FISH GENETICS AND BIOTECHNOLOGY
FISH HEALTH MANAGEMENT
AQUACULTURE PRODUCTION AND ENVIRONMENT
SOCIAL SCIENCE SECTION
CENTRAL PUBLIC INFORMATION OFFICER
VIGILANCE OFFICER

EXECUTIVE SUMMARY

1.	**Name & Address of the Institute**	:	**ICAR-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 (2014-15)

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
695.00	691.80	2101.75	209.22	2310.97	2019.34	204.66	224.00

b) External Sources (Rs. in lakhs)

Source	Amount
BTIS	Nil
Pension & other Retirement Benefits	97.66
ICAR/APA/IPR/NFBSFARA/KVK/NAIP (Plan Scheme)	166.46
Non-plan Scheme	63.11
P Loans & Advances	5.09
Externally Funded Projects	502.88
Total	**835.20**

c) Revenue generated (2014-15) (Rs. in lakhs)

Source	Amount
Farm produce	5.69
Sale of fish and poultry	12.83
Sale of vehicle/other machine tools	-
Sale of publications	0.03
Licence fee/water charges	12.39
Analytical testing fee	0.37
Cost of tender forms	2.68
Services render	0.65
Training	5.62
Miscellaneous	1.35
Interest on loans and advances	10.16
Interest on TDR	30.88
Others (Royalty, & Instt. Charges)	56.72
Total	**139.37**

3. Staff Position (as on 31.3.2015)

Category	Sanction	Position	Vacant
Scientific			
Director	1	1	0
HoD	4	4	0
Principal Scientist	2	0	2
Senior Scientist	12	10	2
Scientist	60	53	7
Total:	**79**	**68**	**11**
Category (Technical)			
T-6	4	0	4
T-3	23	13	10
T-2	3	3	0
T-1 (including Driver)	21	15	6
Total:	**51**	**31**	**20**
Category (Administrative)			
Sr. Administative Officer	1	0	1
A.O.	1	0	1
F&A.O.	1	1	0
A.A.O.	5	3	2
A.F&A.O.	1	1	0
Security Officer	1	1	0
P.S.	1	1	0
P.A.	3	3	0
Assistant	10	7	3
U.D.C.	6	6	0
Junior Steno	1	0	1
L.D.C.	6	3	3
Total:	**37**	**26**	**11**
Supporting			
Skilled Support Staff	120	83	37
G.Total:	**287**	**208**	**79**

Staff Position of KVK (as on 31.3.2015)

Category	Sanction	Position	Vacant
Scientific			
Programme Coordinator	1	1	0
Technical			
Subject Matter Specialist	6	3	3
Programme Assistant	3	2	1
T-1 (Driver)	2	2	0
Administrative			
Assistant	1	0	1
Junior Steno	1	1	0
Supporting			
Skilled Support Staff	2	2	0
Total:	**16**	**11**	**5**

4. Research Projects

a) Institute-based : 14

b) Externally-funded : 25

5. Training programmes conducted

Level	No. of Programmes	No. of Participants
National	20	334
International	1	2

6. Manpower development

a) No. of persons trained at national level : 12

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

7. Workshops organized

National : 2

International : 2

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

Level	No. of Participants
National	50
International	03

9. Infrastructure development

- Committee and Conference Hall renovation
- Experimental tanks for FGBD under NFDB project
- Renovation of Type-III quarters at CIFA Headquarters
- Experimental pond renovation of FNPD
- Experimental tank construction at RRC, Rahara and Kalyani

10. Salient Research Achievements

- Developed package of practices for raising captive brood stock of striped snakehead *Channa striatus* including hormone (HCG and carp PG) dosage, feeding and weaning.
- Produced fry and fingerlings from the gametes of transplanted surrogate broodfish of rohu and catla.
- A low cost bio-sorbent was developed for amelioration of heavy metal contaminated waste water.
- Developed biocompatible digester nucleus for freshwater pearl production.
- Produced 59 families of 6th generation of selectively bred freshwater prawn *Macrobrachium rosenbergii* for improved harvest weight.
- Improved the survival and growth of *Clarias batrachus* larvae using photothermal manipulation.
- Ideal duration of seed stunting was standardised for rohu for optimum compensatory growth during subsequent grow-out phase.
- A powdered bio-fertilizer called "Fish biofert" and a liquid fertilizer called "Fish hydrolysate" developed from fish waste.
- Summer crop model developed for integrated fish farming with high value crops, such as baby-corn, sunflower, hot season tomato, etc.
- Adopted additional villages in Barcote block, Deogarah district for transferring ornamental fish culture technology.

- First time in India, catla selective breeding initiated with 50 fullsib families (generation-1) from eight stocks of base population and monoculture and polyculture farming undertaken along with improved rohu.
- A total of 3.4 million generation-1 (selected for growth) catla and 29.95 million growth-improved rohu seeds supplied to the farming communities in different parts of India.
- Using high throughput sequencing 143.7 million reads and 2, 03,560 SNPs identified in rohu, and 199.5 million reads and 2, 61,445 SNPs identified in Giant freshwater prawn.
- In total 154.5 GB of sequence data with ~110X coverage produced for whole genome sequencing of rohu and generated 46,173 SNPs and 39,742 SSRs.
- For the first time, transfection protocol using nucleofection optimized for rohu spermatogonial stem cells.
- Gene targeting techniques used effectively to integrate TLR22 into fertilized embryos of catla and rohu.
- Population genetic study revealed admixture of Indian major carps of all the peninsular rivers since they might have evolved from the common ancestor.
- For the first time, early and repeated breeding of silver barb achieved using diet CIFABROOD™ and produced 12 million spawn of silver barb by a commercial operator in West Bengal.
- Antioxidant detected in aquatic plants can be incorporated in fish feeds
- Optimum requirement of protein and carbohydrate levels for improved rohu, Jayanti fry worked out as 35% and 30%, respectively.
- Mohua oil cake incorporation in carp feed at 30-40 % level will not produce any adverse effect on the growth and survival of fingerlings.
- Farm-made feed demonstration, training and awareness programmes conducted in Odisha, West Bengal and Chhattisgarh under outreach programme on fish feed.
- Catla induced to breed in January through photothermal intervention.
- OMP and polar flagella identified as virulence associated gene markers for PCR- based diagnosis of *Aeromonas hydrophila* infection in fish.
- Gill associated bacterial isolates shown resistance against multiple antibiotics, a public health concern and a new Myxobolous species was isolated.
- Isolated strain *Bacillus subtilis* (AN11) could be a potential bio-control agent in aquaculture.
- Some bacterial isolates from waste water sediments showed higher nitrification and de-nitrification activity within 30-48 h of incubation.
- Synthesized ZnO & CuO nanoparticles showed broad spectrum antibacterial, antifungal and anti-algal properties upon coating to aquaculture gadgets and improved hatching & survival.
- Argulus infection induced varied immunoglobulin type (IgD, IgM and IgD) expression in skin, mucus and kidney tissue of rohu indicating role of local and systemic immunity during the infection process.
- Rohu seems to be extreme susceptible species to *Argulus siamensis* infection in experimental trial conducted with eight carp species.
- Under active targeted disease surveillance, 190 samples of carps found negative for SVCV, 182 for KHV in PCR/RT-PCR.
- Hands on training imparted to women beneficiaries on post-harvest value addition technology of freshwater fish.
- On-farm demonstration on nursery rearing of genetically improved rohu (Jayanti) spawn was undertaken and after one month of nursery rearing, survival of 41% and 55% in the village ponds of Kheda and Anand district of Gujarat respectively.

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

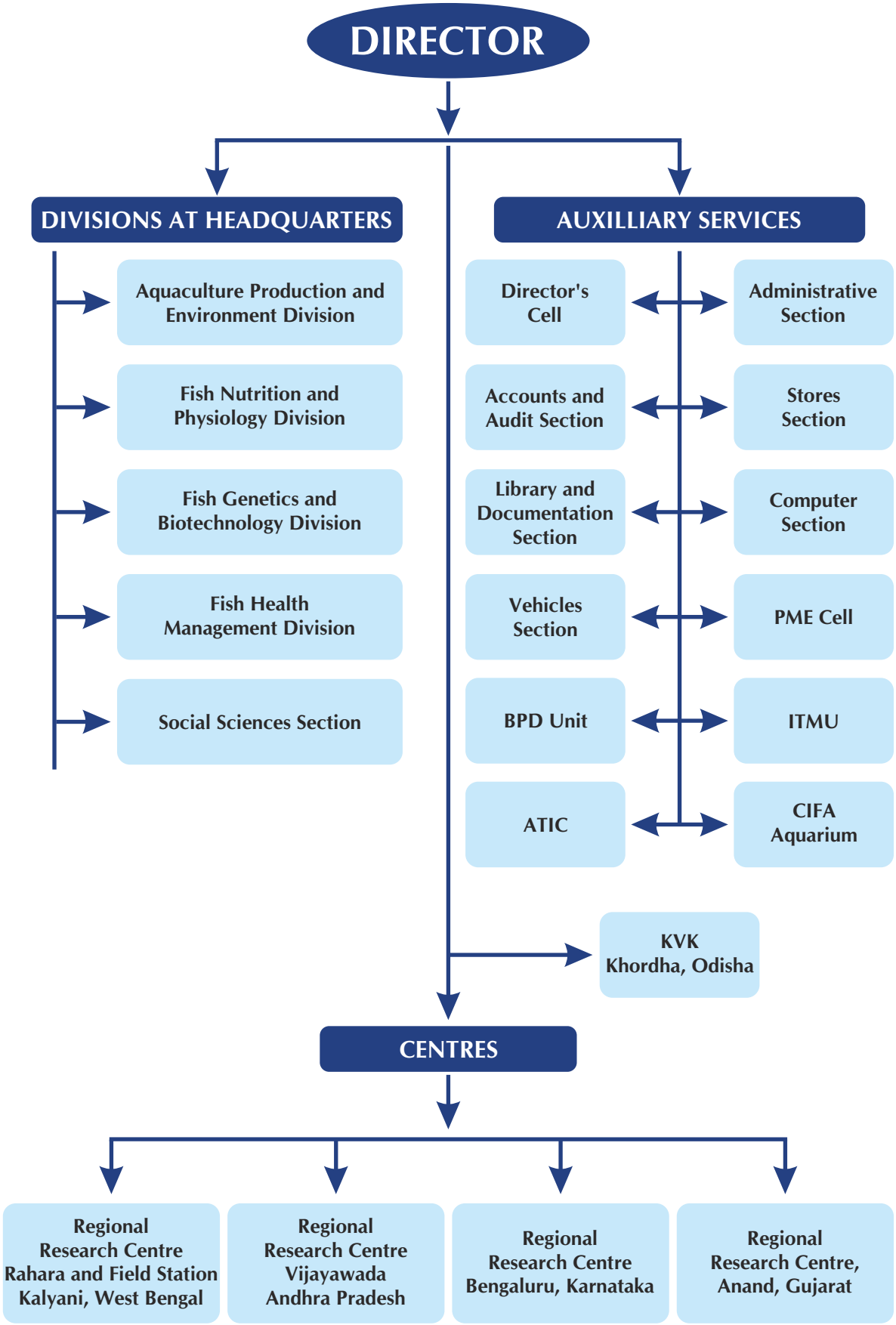
The Central Institute of Freshwater Aquaculture had its beginnings as the Pond Culture Division of the Central Inland Fisheries Research Institute, which was established at Cuttack, Odisha in 1949. The Division was later upgraded as the Freshwater Aquaculture Research and Training Centre (FARTC) established 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



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 2015
Project Personnel	:	Rajesh Kumar (PI), Kuldeep Kumar (up to March 2013), A. K. Sahu (up to September 2013) and U. L. Mohanty

Development of protocol for raising striped snakehead brood in concrete cisterns

Protocol has been developed for growing of striped snakehead broodstocks in concrete tanks with the manipulation of habitat, feed and inducing hormones. Fishes were fed 3% of their biomass i.e., live insects/ prawn/ small fish 1% and trash fish & rice bran (3:1) 2%. Sustained hormone pellets of HCG (400-500 IU/kg body weight) was implanted intramuscularly in brood fish during month of February and fishes got fully mature in the month of April. Hormone implanted fishes showed better spawning response. This technique has several advantages like regular examination of maturity, proper care to brooders, easy to implant hormone pellets and post-operative care, easy catching & minimum handling stress before induced breeding, etc.

Standardization of hormone dose for induced breeding of striped snakehead

Striped snakehead was successfully induced bred with human chorionic gonadotropins (HCG) and carp pituitary gland extract (CPGE). The numbers of induced breeding trials were made with HCG and CPGE at varied doses to know the optimal dose of a particular inducing agent for better spawning of both female and male fish. Optimal dose of HCG for female and male fish was 1500 IU/kg body weight and 1000 IU/kg body weight, respectively. Similarly, the optimal dose of CPGE for female and male fish was 40 mg/kg body weight and 30 mg/kg body weight, respectively.

Standardization of captive induced breeding technology for striped snakehead

Striped snakehead brooders raised in concrete cisterns, with proper management practices, remains fully mature from mid-April to mid-September. The numbers of successful breeding trials were taken during that period with human chorionic gonadotropins and carp pituitary gland extract. Fertilized eggs were spherical, free floating and straw-yellow in colour. Spawning and hatching time varied between 16-18 h and 20-24 h, respectively at 26-30 °C. The fertilization and hatching rate ranged between 85-98% and 80-95%, respectively.

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

Captive breeding of *Dawkinsia tambraparniei*

Dawkinsia tambraparniei (Silas 1954) bred in third consecutive year in the hatchery facility of CIFA, Bhubaneswar in July- August. Based on the monsoon and ambient temperature, the spawning period of the fish varies and observed to be in between July-October at Bhubaneswar. In monsoon season, milting males and oozing females were selected from conditioning tank and stocked in breeding hapas for captive breeding. To simulate the natural rainy condition, a shower was set up on the top side of hapa.

Brooders were injected with a small dose of ovaprim (0.05ml/fish) for induced breeding. Spawning occurred within 8-10 hours of post ovaprim administration. The eggs were sticky in nature (Fig. 6) and their size ranged between 0.4-0.5 mm. Fecundity ranged between 400-2000 numbers of eggs for fishes having a total length ranged between 60-90 mm. Larvae reach 15-20 mm size in one month of rearing with the development of five vertical bands and the reddish orange coloured fins.

The larvae looked banded (vertical) in initial period. After three months of rearing, bands slowly disappear and remain to half of the body. The fishes were readily matured in captivity for a period of 10-12 months. Due to fully developed ovary the females belly normally be in bulged condition during monsoon season. In males, testis (Figure 8) was found to be functional throughout the year irrespective of the season.

Stock maintenance at RRC, Bangalore

Fishes of size 20-30 mm (captive bred stock) were transported and stocked at RRC of CIFA, Bangalore. The fishes were acclimatized and stocked in cement tanks. Floating pellet feed was mainly fed to the juveniles and the fish were matured in the new environment at RRC. They attained a size of more than 80 mm after a period of eight months. A new stock of fish were also collected from tamarabarani river (TN) recently and stocked at RRC farm, for captive breeding and larval rearing at the Centre.

Feeding juveniles with different levels of spirulina for colour retention (RRC, Bangalore)

Study on colour retention of Dawkinsia tambraparniei juveniles with experimental diets containing varied levels of spirulina (5, 10, 15 & 20% -T1, T2, T3 & T4) as pigment source was conducted. Water quality parameters like temperature, pH, alkalinity, hardness, ammonia, nitrate and phosphates were monitored on a weekly basis. Mortality was nil during 45 days of experiment. The feed with 10% spirulina showed better water quality throughout the experiment and feed with 15% spirulina indicated good colour retention compared to other levels of spirulina. Length (Fig. 1) and weight gain (Fig. 2) were also monitored during the period. From the graph, it was evident that T3 performed well as far as length gain is concerned however in case of weight gain, T4 performed better as compared to other formulated diets.

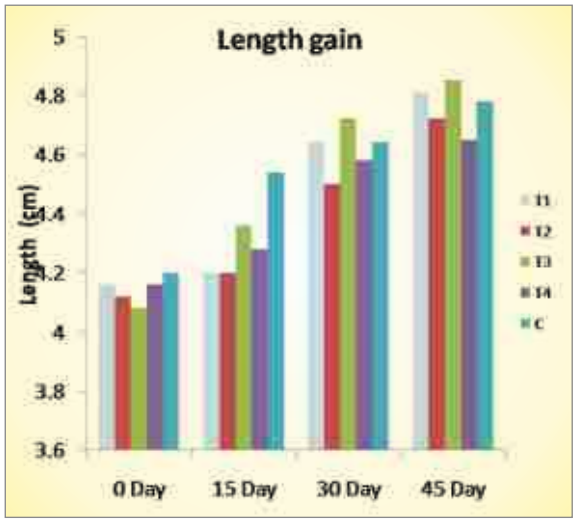


Fig. 1.

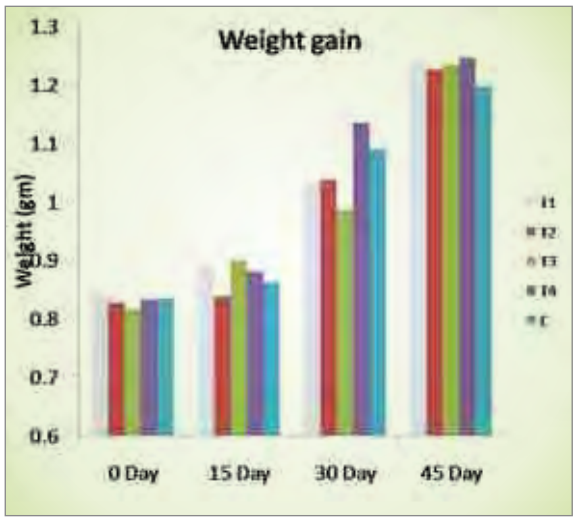


Fig. 2.

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), S. Nandi and D. K. Verma

Gonadal regression and depletion of germ cells in carps by different methods

Here we analyzed the effects of different rearing water temperatures (28 ^{0}C, 30 ^{0}C, 32 ^{0}C, 34 ^{0}C and 36 ^{0}C) and a cytotoxic drug (busulfan) on germ cell status and maturation in Indian major carp, Labeo rohita. The effectiveness of the treatment was assessed by gonad somatic index, histology, dye

uptake of GC and embryonic development. Gonadal morphology visibly shrunk after the thermo-chemical treatments. Similarly, the gonadal histology confirmed that the GC depletion took place when the rohu were reared at elevated temperature along with the application of a cytotoxic drug busulfan (40 mg kg^{-1}). Elevated temperature during embryonic incubation resulted in premature hatching of larvae and also produced several malformed larvae (Figs. 3-5).

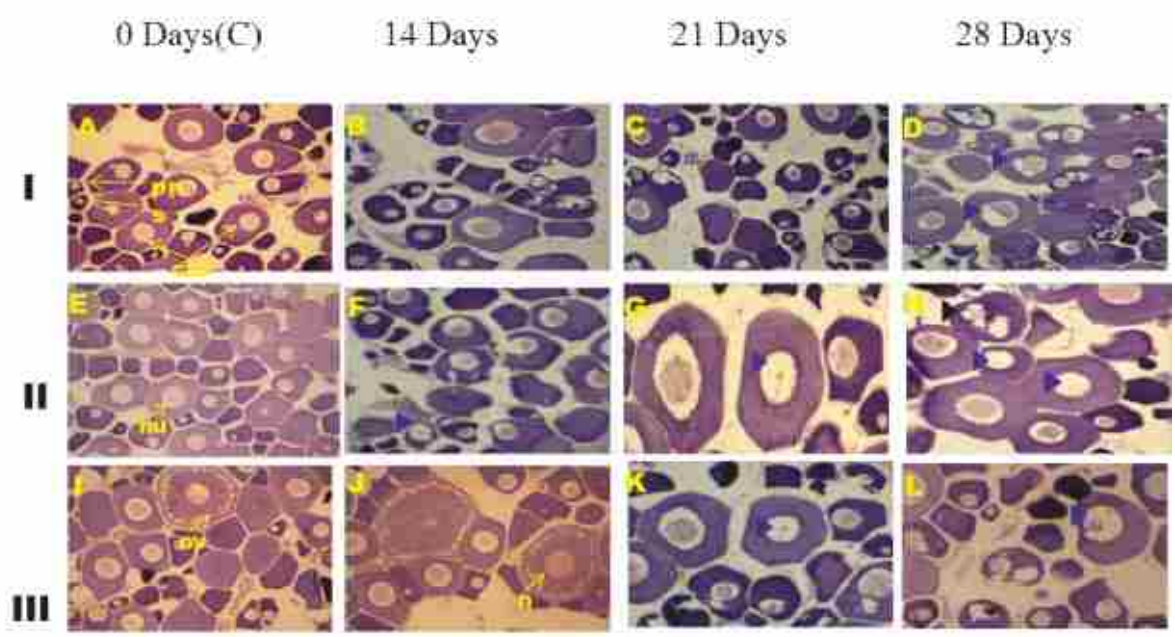


Fig. 3. Histological changes in the ovary of rohu females subjected to (I) Elevated water temperature (34 ^{0}C), (II) Intraperitoneal busulfan administration (40 mg/kg) & (III) Combination of elevated temperature with 40 mg/kg busulfan dose. A, E, I, Start of the experiment; oocytes at various stages indicating active oogenesis (0 days; perinuclear oocytes (pns) or immature oocyte, cortical alveolus oocytes (cas) or mature oocyte, nucleolus (nu), oil vesicles (ov). B, F, J, 14 days (arrow head indicates absence of prominent cysts of oogonia , C,G,K, 21 days (the absence of oogonia and other types of GCs, D,H,L 28 days (arrow head indicates degeneration of oogonial cells).

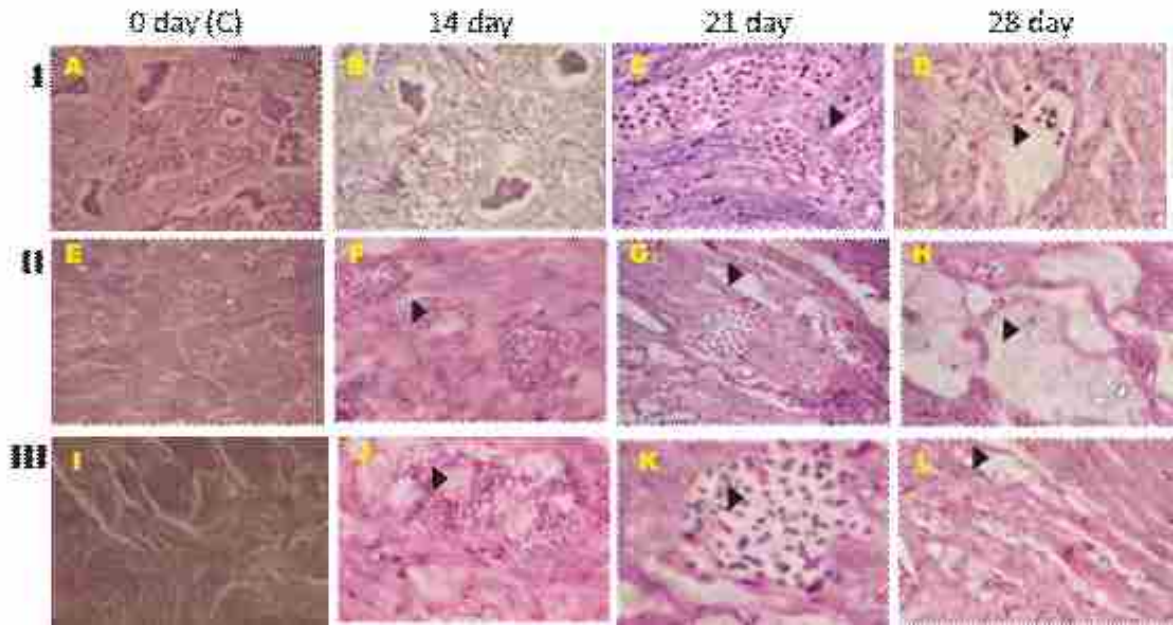


Fig. 4. Histological changes in the testes of males subjected to (I) elevated water temperature (34 ^{0}C), (II) Intraperitoneal busulfan administration (40 mg/kg) & (III) combination of elevated temperature with 40 mg/kg busulfan dose. A,E,I) Start of treatment (0 days; active spermatogenesis within the lobules). B,F,J) 14 days (arrow head indicates absence of spermatogenic cysts) C,G,K) 21 days (arrow head indicates the absence of spermatogonia). D, H, L) 28 days (arrow head indicates complete absence of GCs).

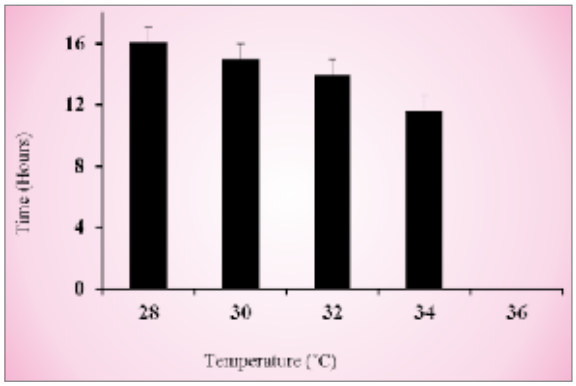


Fig. 5. Effect of different incubation water temperatures on the hatching time of *Labeo rohita*. Data shown as mean ± SEM (vertical bars).

Xenogenic transplantation of germ cell in carps and surrogate fish production

Successful production of surrogate broodfish (host fish that received Germ Cell transplantation) and fry and fingerlings (seed produced from the gametes of transplanted surrogate brood fish) of carps has been achieved at ICAR-CIFA for the third consecutive year of the experimentation starting from 2011-12. This was possible after successful xenogenic transplantation of isolated germ cells (GCs) in carps (catla, *Catla catla;* rohu, *Labeo rohita* and common carp, *Cyprinus carpio*) for the first time. Under this project, the 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 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 (rohu x catla; catla x rohu) or a normal catla or a normal rohu. This research breakthrough has confirmed that donor derived gametes can be produced in a related host species (carp to carp). Similarly, catla and rohu GCs were transplanted to commom carp, *Cyprinus carpio* males and females and induced spawning (stripping) was conducted between: male common carp x female catla; male catla x female common carp; male common carp x female rohu; male rohu x female common carp). A successful transplantation for surrogate brood fish and subsequent seed productions from these are shown in the Table 1 & Fig. 6.

Table 1. Seed production from carp surrogates after GC transplantation with confirmatory test.

Germ Cell Donor fish species with sex	GC Recipient fish (RF) species with sex	Mating between	Resultant Fry/Fingerling	Confirmatory Test
♂ Catla	♂ Rohu	♂ RF x ♀ Rohu	60% pure Rohu and 40% Catla- Rohu hybrid	Morphology and nuclear marker
♂ Catla	♀ Rohu	♂ Catla x ♀ RF	70 % Rohu-Catla hybrid and 30% pure rohu	Morphology and nuclear marker
♀ Catla	♀ Rohu	♂ Rohu x ♀ RF	35 % Catla-Rohu hybrid and 65% pure rohu	Morphology and nuclear marker
♀ Catla	♂ Rohu	♂ RF x ♀ Catla	68 % Catla-Rohu hybrid and 32% pure rohu	Morphology and nuclear marker
♂ Rohu	♂ Catla	♂ RF x ♀ Catla	63 % pure Catla and 38 % Rohu-Catla hybrid	Morphology and nuclear marker
♂ Rohu	♀ Catla	♂ Rohu x ♀ RF	65 % Catla-Rohu hybrid and 35 % pure rohu	Morphology and nuclear marker
♀ Rohu	♀ Catla	♂ Catla x ♀ RF	58 % pure Catla and 42% Catla-Rohu hybrid	Morphology and nuclear marker
♀ Rohu	♂ Catla	♂ RF x ♀ Rohu	60 % Catla-Rohu hybrid and 40 % pure rohu	Morphology and nuclear marker
♂ Catla	♂ Common Carp (CC)	♂ RF x ♀ Catla;	CC was 90%, only 10% CC-Catla hybrid. High rate of mortality recorded in hybrids.	Morphology

♂ Catla	♀Common Carp (CC)	♂ Catla x ♀RF	Catla-CC hybrid was 95 %, only 5 % Catla. High rate of mortality recorded in hybrids.	Morphology
♂ Rohu	♂ Common Carp (CC)	♂ RF x ♀Rohu	CC-Rohu hybrid was 90 %, only 10 % pure rohu. High rate of mortality recorded in hybrids.	Morphology
♂ Rohu	♀Common Carp (CC)	♂ Rohu x ♀ RF	Rohu-CC hybrid was 92 %, only 8 % pure rohu. High rate of mortality recorded in hybrids.	Morphology

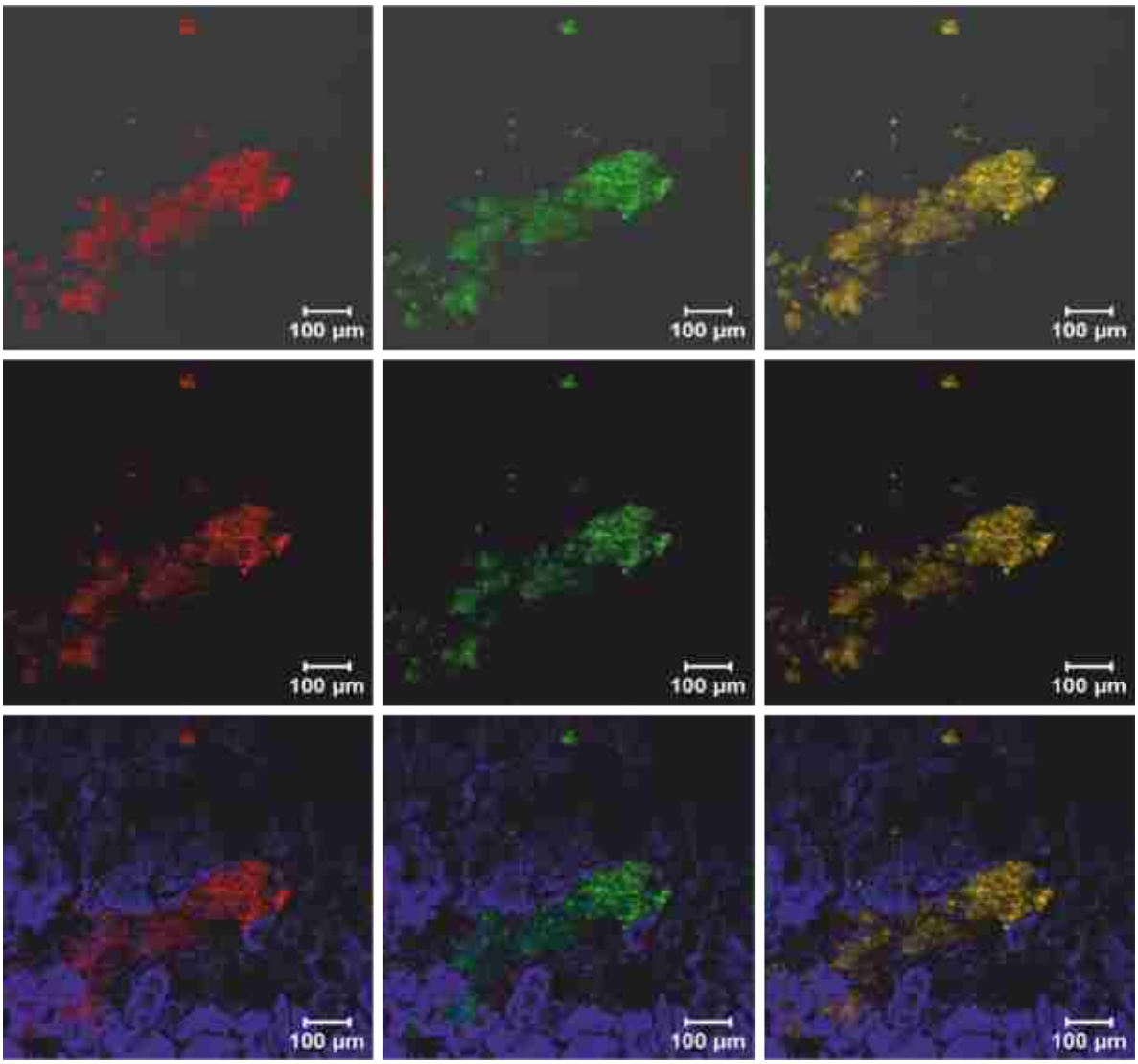


Fig. 6. Transplanted rohu testis showing colonization of germ cells. Red stained cells show PKH 26 and Green ones are PKH 67 dyed cells, Third column shows the merged view.

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

Two growth performance studies, one for evaluating 2-12 month stunted rohu seed raised at 20 and 40 m^{-2} densities and the other for evaluating similar sized normal vs. one year stunted fingerlings were conducted for one year grow-out period. Seeds stunted for 2-12 months were stocked in separate 0.09 ha ponds at 8000 ha^{-1}, composed of 50% seed from each densities. Fifteen individuals from each density category were tagged to track their individual growth performance over time. In the second study, a 0.09 ha pond was stocked with at 8000 ha^{-1} with fingerling stunted at 40 m^{-2} density for 12 months and similar sized normal fingerling at 1:1 ratio and 25 individuals from each group were tagged.

Survivals percentages in different stunting groups of the first study (Table 2) were 85.6-96.3%. Duration of seed stunting showed positive correlation with survival. Seed stunted for 4-month recorded significantly higher ABW (772.4 ± 99.8 g) and biomass production (5.35 t/ha) followed by 2-month group. While fish yield in the rest 6- to 12-month stunted groups were lower despite their increasing survival, the ABW gradually reduced in seed which were stunted for increased duration ($P > 0.05$). The second study on normal fingerlings vs. stunted yearling also revealed similar weight attainment in both after 6 and 12 months of grow-out culture ($P > 0.05$) (Table 3). Such results from the above two studies indicated that neither the density nor the duration of seed stunting has any positive implication towards the compensatory growth process in rohu during post-stunting grow-out phase, especially when the stunting duration is more than four months.

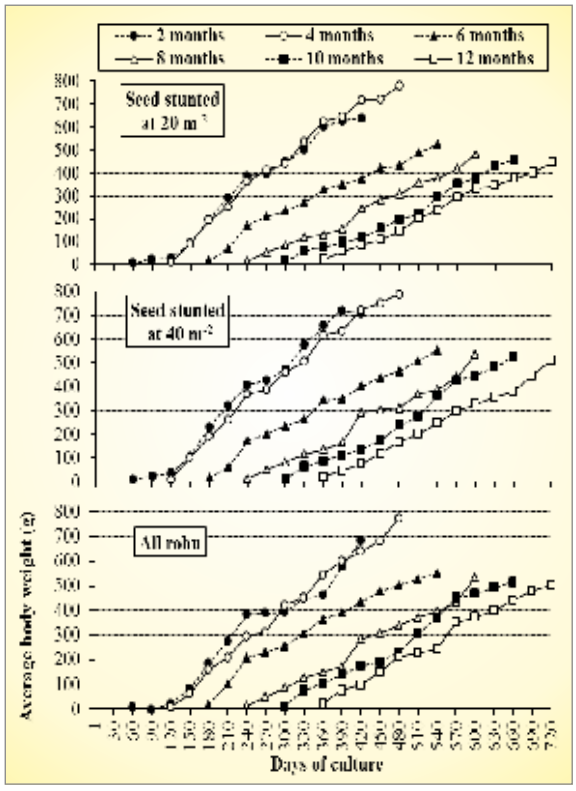


Fig. 7. Growth curves during the one year grow-out culture in the rohu seed stunted for varied duration

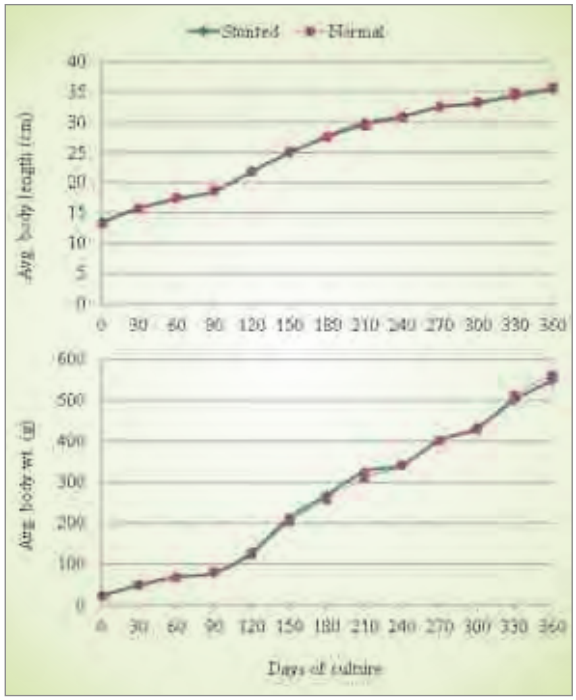


Fig. 8. Growth curves during the one year grow-out culture in stunted and normal rohu seed

Table 2. Yield attributes of rohu seed stunted for varied duration in the subsequent grow-out phase under monoculture

Treatment (stunting duration)	Category of stunted seed	*Average growth after 12 months		**Specific growth rate (% per day)			Survival (%)	Gross Biomass (kg ha^{-1})	FCR
		Length (cm)	Weight (g)	Up to 6 month	7-12 months	One year			
T-1 (2 months)	20 m^{-2} (Tag)	^{x}37.0±1.6	^{x}639.3±97.4	2.17±0.10 ^{a}	0.28±0.08 ^{cd}	1.22±0.06 ^{a}			
	40 m^{-2} (Tag)	^{x}38.2±2.7	^{x}707.5±162.4	^{p}2.16±0.12	^{r}0.30±0.10	^{p}1.23±0.08			
	All rohu	^{x}37.6±2.8 ^{B}	^{x}682.6±174.9 ^{B}	2.16±0.11 ^{A}	0.29±0.09^{CD}	1.23±0.07 ^{A}	85.6	4674.4	2.37
T-2 (4 months)	20 m^{-2} (Tag)	^{y}39.9±2.0	^{y}782.2±122.6	2.10±0.09 ^{a}	0.31+0.05 ^{cd}	1.21±0.06 ^{a}			
	40 m^{-2} (Tag)	^{y}40.0±1.7	^{y}789.6±109.0	^{p}2.09±0.09	^{r}0.30±0.06	^{p}1.20±0.08			
	All rohu	^{y}39.7±1.6 ^{A}	^{y}772.4±99.8 ^{A}	2.10±0.09 ^{B}	0.30±0.06 ^{C}	1.20±0.05 ^{A}	86.5	5345.0	2.59
T-3 (6 months)	20 m^{-2} (Tag)	^{z}34.5±1.7	^{z}527.6±79.8	1.62±0.15 ^{b}	0.24±0.05^{e}	0.94±0.08 ^{b}			
	40 m^{-2} (Tag)	^{z}35.0±1.7	^{z}556.1±80.2	^{q}1.68±0.16	^{r}0.27±0.07	^{q}0.98±0.08			
	All rohu	^{z}34.9±2.3 ^{C}	^{z}549.4±122.8 ^{C}	1.65±0.16 ^{C}	0.27±0.06 ^{D}	0.96±0.08 ^{B}	91.4	4017.2	3.30
T-4 (8 months)	20 m^{-2} (Tag)	^{p}34.2±1.6	^{p}481.1±46.1	1.50±0.09 ^{c}	0.38±0.05^{b}	^{q}0.94±0.08 ^{b}			
	40 m^{-2} (Tag)	^{p}35.2±1.6	^{p}507.0±60.1	^{q}1.69±0.16	^{r}0.32±0.07	1.01±0.03			
	All rohu	^{p}35.1±2.6 ^{C}	^{p}532.5±77.8 ^{C}	1.60±0.13 ^{D}	0.35±0.07 ^{B}	0.97±0.05 ^{B}	92.9	3957.5	3.14
T-5 (10 months)	20 m^{-2} (Tag)	^{b}33.4±1.5	^{b}459.5±55.5	1.43±0.07 ^{c}	0.47±0.07^{a}	0.95±0.04 ^{b}			
	40 m^{-2} (Tag)	^{a}34.8±1.4	^{a}513.5±64.8	^{r}1.57±0.10	^{p}0.45±0.08	^{q}1.01±0.05			
	All rohu	^{a}35.3±1.6 ^{C}	^{a}514.7±81.0 ^{C}	1.50±0.11 ^{E}	0.46±0.08 ^{A}	0.98±0.06 ^{B}	93.8	3862.3	3.34
T-6 (12 months)	20 m^{-2} (Tag)	^{n}33.8±1.3	^{n}448.8±47.1	1.27±0.05 ^{d}	0.35±0.04^{bc}	0.81±0.03 ^{c}			
	40 m^{-2} (Tag)	^{m}35.8±1.5	^{m}512.9±82.0	^{s}1.37±0.06	^{q}0.38±0.07	^{r}0.87±0.05			
	All rohu	^{m}35.5±1.7^{C}	^{m}502.8±64.7^{C}	1.32±0.08 ^{F}	0.36±0.06 ^{B}	0.84±0.05 ^{C}	96.3	3873.6	3.37

*Mean ±SD with different superscript capital alphabet on the right hand side in a coloumn differ significantly ($P<0.05$, $n=25$); Mean ±SD with same superscript on the left hand side in a coloumn did not differ significantly ($P>0.05$, $n=15$) within the particular treatment

** SGRs of a particular density category with the same superscript (on left for 40 m^{-2} density, $n=15$; right for 20 m^{-2} density, $n=15$; capital alphabet superscript for all rohu, $n=30$) in a coloumn did not differ significantly ($P>0.05$) within a treatment

Table 3. Yield attributes of stunted and normal rohu seed in subsequent grow-out phase.

Category of seed	Length (cm)			Weight (g)			Survival (%)	Gross biomass (kg ha^{-1})
	1day	180 days	360 days	1day	180 days	360 days		
Stunted	13.6±0.6	28.0 ±1.1^{a}	35.5 ±1.7^{a}	23.9 ±3.3	276.7 ±35.2^{a}	557.4 ±19.3^{a}	90.4	4055
Normal	13.2 ±0.6	27.5 ±1.2^{a}	35.8 ±0.9^{a}	22.7 ±3.5	256.7 ±34.2^{a}	560.7 ±46.3^{a}		
All rohu	13.3 ±0.2	27.6 ±1.5^{a}	36.4 ±1.5^{a}	23.0 ±0.6	258.8 ±22.9^{a}	586.6 ±70.6^{a}		

*(Mean ±SD) of the treatments with different superscript on the right hand side in a coloumn differ significantly ($P<0.05$, $n=25$)

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, S. Chand Mathuria, P. B. Bhakat and D. Majhi

Tilapia fish were stocked in February 2014 in three tanks of flow-through cisterns (each 10 m^2 surface area and 1.0 m depth) without water flow. Stocking density was the variable. In T-1 total 200 no. of fish with total biomass of approximately 2 kg; in T-2 total 360 no. of fish with total biomass 4 kg and in T-3 total 756 no. of fish with total biomass 8 kg were stocked. Fish stocked in T-1 attained average size of 102 ± 14.18 g and 215 ± 21.98 mm with 88.5% survival. Fish stocked in T-2 attained average size of 76 ± 16.96 g and 197 ± 19.32 mm with 87.2% survival. Fish stocked in T-3 attained average size of 54 ± 18.07 g and 175 ± 20.28 mm with 85.1 % survival. After harvesting from the three experimental tanks the total fish biomass was 17.95, 23.86 and 34.77 kg of fish from T-1, T-2 and T-3, respectively (Tables 4&5). From the experiment it is concluded that less stocking density resulted more body weight gain in fish than the higher density.

Table 4. Growth of tilapia in flow-through cisterns without water flow

	Initial stocking	Final harvest		
		T-1	T-2	T-3
Length (mm)	78.5 ± 9.42	215 ± 21.98	197 ± 19.32	175 ± 20.28
Weight (g)	10.6 ± 2.37	102 ± 14.18	76 ± 16.96	54 ± 18.07

Table 5. Water parameters of experimental cisterns

Tank No	pH	Conductivity (μS)	DO (mg/l)	CO_2 (mg/l)	Alkalinity (mg/l)	Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)
T-1	7.52 ± 0.17	613.67 ± 22.15	3.43 ± 0.4	8.33 ± 1.85	114.67 ± 3.63	0.24 ± 0.06	0.06 ± 0.04	0.21 ± 0.06
T-2	7.48 ± 0.09	615.61 ± 33.52	3.28 ± 0.53	8.89 ± 1.57	109.78 ± 9.02	0.28 ± 0.06	0.09 ± 0.05	0.23 ± 0.07
T-3	7.45 ± 0.11	624.50 ± 24.23	3.18 ± 0.42	9.00 ± 1.57	108.22 ± 9.65	0.34 ± 0.08	0.10 ± 0.04	0.23 ± 0.07

Tilapia fish were stocked in December, 2014 in silo tank (made up of FRP with dia 2.15 m, depth 0.9 m and water holding capacity 3000 litre). 330 number of tilapia were stocked having length and weight 200.5 ± 19.80 mm and 90.9 ± 20.19 g, respectively. The stocking density was 10 kg/m^3. Daily 1/3rd of silo water was exchanged. Floating feed was applied @ 1-2% of total biomass. After 3 months of stocking, 320 numbers of fish were harvested from silo tank with 96.97% survivability. Their length and weight were measured 206.6 ± 25.48 mm and 105.65 ± 29.27 g respectively (Table 6). From this experiment it was concluded that 11.2 kg/m^3 biomass of tilapia can be kept for 90 days in silo of 3000 litre capacity.

Table 6. Growth of tilapia in silo

	Initial	Final
Length (mm)	200.5 ± 19.80	206.6 ± 25.48
Weight (g)	90.9 ± 20.19	105.65 ± 29.27

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

Morphometric evaluation of *Macrobrachium malcolmsonii*

Macrobrachium malcolmsonii adult specimens of 312 and 241 numbers from Mahanadi river, Odisha and Godavari river, Andhra Pradesh, respectively were collected for morphometric studies. The morphometric evaluation showed difference between the stocks. All the morphometric parameters including TL, CL, SL and BW of Andhra Pradesh stock was observed to be higher compared to Odisha stock in pooled sex. Sexual dimorphism in the morphometric characters were also clearly 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. The morphometric analysis showed positive allometry with a slope of 3.358727 in Godavari stock, whereas it follows isometry with a slope of 3.181657 in Mahanadi stock indicating faster weight gain in Andhra Pradesh stock compared to that of Odisha stock. The condition factor (K) was also found to be higher in Andhra Pradesh stock compared to Odisha stock (Fig 9).

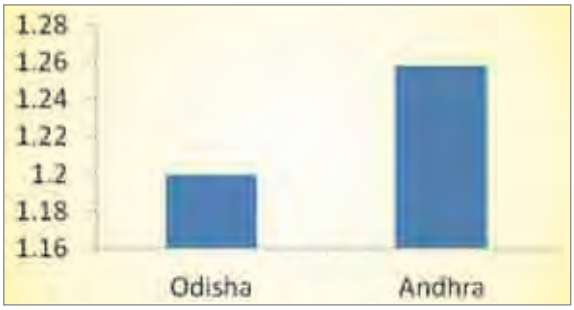


Fig. 9. Condition factor of *M. malcolmsonii* from Mahanadi river, Odisha and Godavari river, Andhra Pradesh

Collection of *Macrobrachium malcolmsonii*

A total of 4800 juveniles of *Macrobrachium malcolmsonii* juveniles were collected from Daya river near Balakati, Odisha. The average weight at the time of collection was 0.53 g and the juveniles were stocked in two ponds of 0.06 ha each at a density of 3 nos/m^2. The important water quality parameters were measured once every week using standard procedures and growth was monitored by regular sampling.

Carcass evaluation

Adult prawns of were collected and subjected to carcass evaluation. The prawns were segregated based on sex and peeled by hand to evaluate the meat yield pattern. Several yield parameters including total length, body weight, sex, head weight, weight, tail meat weight and tail shell weight were recorded and the percentage contributions of meat yield were then worked out for different size classes. The meat yield was found to be slightly higher in Odisha stock compared to that of Andhra Pradesh stock (Fig. 10). The meat yield percentage ranges from 27.22 ± 1.55 to 42.06 ± 0.46% in Odisha whereas it ranges from 25.06 ± 1.95 to 40.33 ± 1.54%in Andhra Pradesh stock. In addition, it was observed that the meat yield of prawn also depend on sex size (Figs. 11&12) in the weight class of 31-40 g and above. 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.

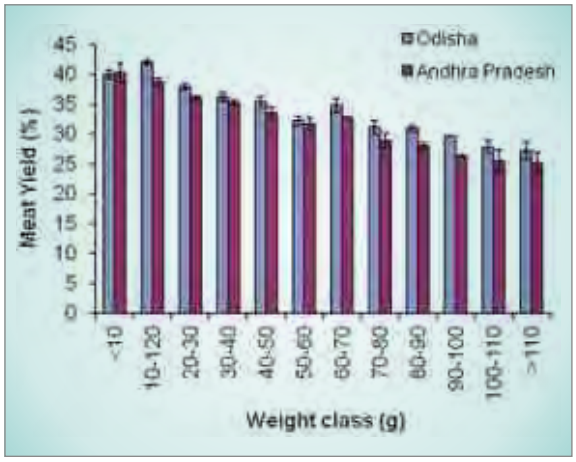


Fig. 10. Meat yield characteristics of *M. malcolmsonii* from Mahanadi river, Odisha and Godavari river, Andhra Pradesh

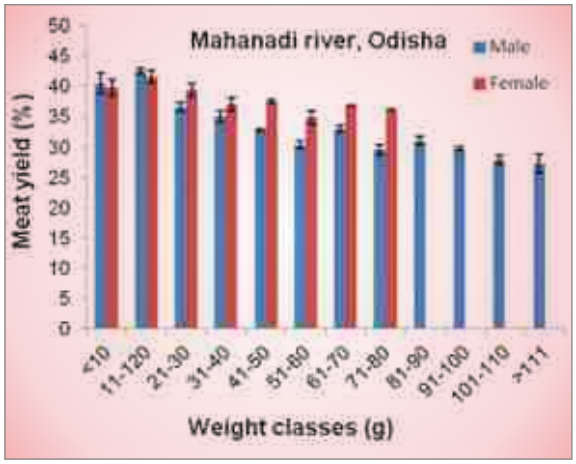


Fig. 11. Sex wise meat yield variation in *M. malcolmsonii* from Mahanadi river, Odisha

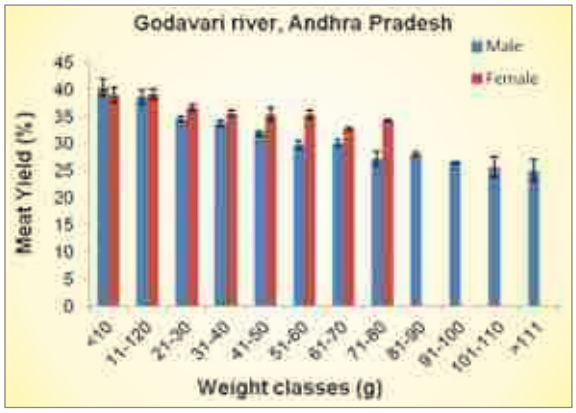


Fig. 12. Sex wise meat yield variation in M. malcolmsonii from Godavari river, Andhra Pradesh

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 carp and pangas culture practices

The water quality index (WQI) was prepared for the carp culture ponds of some districts of Odisha based on the following water quality of carp culture ponds at initial level and at the harvest time: dissolved oxygen (DO), pH, conductivity (EC), total alkalinity, hardness, nitrate, and phosphate. The average value of these parameters were 4.0 mg/l, 7.5, 0.315 μS/cm, 80 mg/l, 70 mg/l, 0.03 mg/l and 0.005 mg/l, respectively at the initial level of culture and the average value of these parameters were 5.0 mg/l, 7.9, 0.485 μS/cm, 100 mg/l, 90 mg/l, 0.35 mg/l and 0.25 mg/l, respectively at the harvest time. The estimated WQI was 57 at the initial level and 100 at the harvest. Accordingly, the good water quality tended to be poor at the harvest time. The WQI was also prepared for the carp culture practices in Kolleru lake area, Andhra Pradesh. The average value of dissolved oxygen (DO), pH, conductivity (EC), total alkalinity, hardness, nitrate, and phosphate were 4.0 mg/l, 7.5, 1.1 μS/cm, 220 mg/l,150 mg/l, 0.12 mg/l, and 0.25 mg/l, respectively at the initial level. The same were 6.0 mg/l, 8.0, 1.8 μS/cm, 400 mg/l, 270 mg/l, 0.28 mg/l, and 0.55 mg/l, respectively at the harvest time. The estimated WQI was 121 at the initial level, and 206 at the harvest time.

The WQI was also prepared for the pangas culture practices in Kolleru lake area, Andhra Pradesh. The average value of dissolved oxygen (DO), pH,

conductivity (EC), total alkalinity, hardness, nitrate, and phosphate were 4.0 mg/l, 7.8, 1.49 μS/cm, 240 mg/l, 160 mg/l, 0.0.30 mg/l, and 0.50 mg/l, respectively at the initial level. The same were 6.0 mg/l, 8.1, 3.72 μS/cm, 450 mg/l, 290 mg/l, 0.80 mg/l, and 1.20 mg/l, respectively at the harvest. The estimated WQI was 160 at the initial level, and 337 at the harvest. Accordingly, the poor quality water tended to be degraded at the harvest.

Water budget for carp culture pond in Odisha, West Bengal and Andhra Pradesh

The evaporation and seepage loss from the aquaculture ponds in the districts of Cuttack, Kendrapara, Jajpur, Nimapara, and Puri of Odisha were 16600 and 7050 m^3, respectively. The annual rainfall, run-off, and well water added to these ponds to compensate the annual loss of evaporation and seepage were 17900, 1500, and 17300 m^3, respectively. The production for carp culture (three species @ 1:1:1 ratio) ranged from 6250 to 8000 kg/ha in these ponds. Accordingly, the consumptive water use varied from 2.96 to 3.79 m^3/kg, while the total water use varied from 4.58 to 5.87 m^3/kg in Odisha. The evaporation and seepage loss from the aquaculture ponds in the districts of South and North 24 Parganas, Burdwan and Nadia of West Bengal were 15200 and 9000 m^3, respectively. The annual rainfall, run-off, and well water added to these ponds were 16600, 900, and 17300 m^3 respectively. The production for carp culture (three species @ 1:1:1 ratio) ranged from 6250 to 8500 kg/ha in these ponds. Accordingly, the consumptive water use varied from 2.84 to 3.87 m^3/kg, while the total water use varied from 4.09 to 5.56 m^3/kg in West Bengal.

Increase in water productivity by management practices

A case study was performed in two different locations at Cuttack and one location at Jagatsinghpur districts of Odisha to evaluate the increase in water productivity by adopting recommended carp culture practices over farmer's traditional practices. In the recommended practice, stocking density was 10,000/ha, lime application was @ 600 to 1500 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. While in the recommended practice, the water quality parameters, viz. pH was 7.6 to 8.0, total alkalinity was 90 to 120 mg $CaCO_3$/l, dissolved phosphate was 0.35 to 0.85 mg/l, and dissolved nitrogen was 0.70 to 1.50 mg/l. Total fish production was 3.25 to 4.2 t/ha/yr in farmer's practice while the same was 5.0 to 8.0 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 0.17 to 0.22 kg/m^3 in the farmer's practice while the same was 0.27 to 0.42 kg/m^3 in the recommended practice.

Uses of eco-friendly chemicals for reduction of alkalinity of water

An experiment was conducted to study the efficiencies of gypsum used in white brick manufacturing and gypsum used in agriculture and alum for reduction of alkalinity in waters. The results showed that alum was most effective compared to the gypsum but the requirement of gypsum was much more than that of alum. The requirement of alum was 1.5 units to reduce 1.0 unit total alkalinity while the requirement of gypsum was 8 to 10 units per unit reduction of total alkalinity. The cost of gypsum is considerably cheaper compared to alum.

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

Development of polymer based Designer Nucleus

The designer nucleus was prepared by using polymer based substance. The average size of the nucleus was 1.2 cm. Economics of the designer nucleus was calculated and found that per nucleus cost was 40-46 paise. The prepared nucleus was also tested in freshwater mussel, *Lamellidens marginalis* and found that the nucleus was biocompatible with mussel and can be potentially utilized for production of freshwater pearl.

Development of polymer based round nucleus

High quality polymer based round nucleus of different size viz., 2 mm, 3 mm and 5 mm were prepared and economics of the nucleus production were worked out and found that the unit per nucleus cost was 5.49-9.62 paise. The same nucleus was implanted in visceral organ of the mussel to check its biocompatibility and the preliminary experiment suggests that this nucleus is non- lethal to animals and good survivality was also recorded.

Efficacy of clove oil as relaxant for freshwater mussel *(L. marginalis)*

An experiment was conducted to check the efficacy of clove oil as a relaxant in freshwater mussel. Three concentrations of clove oil viz., 500 μl, 1 ml/l and 2 ml/l were tested. Preliminary observation suggests that clove oil can be used as a relaxant during operation.

Evaluation of dietary supplementation of spirulina in pearl mussel

An experiment was conducted to evaluate the possibility of incorporation of spirulina granules as feed in the freshwater mussel culture. Results showed that survivality of implanted mussel were 89% in 75 days of culture duration and it can be incorporated as a dietary source in the confined culture of mussel.

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, K. C. Das and D. K. Verma

Collection of tilapia populations from different geographical locations and rearing

Tilapia populations were collected from four different locations named viz. West Bengal (farmer pond) – WB Population; Gujarat (Bhuj Resrvoir, Rudramata Dam)-RM Population; Odisha (a GIFT stock originally received in 1998 and bred and cultured till 2000)- CIFA-OD Population and domestic tilapia from ponds of Gujarat- GP Population. Growth and truss analysis revealed that there is phenotypic variation in the collected population making it suitable for variety development (Figs. 13-14).

Fig. 13. TRUSS Analysis using anatomic landmarks and design of the truss network used in tilapia morphometric analysis. Distances used in multivariate methods (t1–t17) were defined by landmarks 1–10 (truss network).

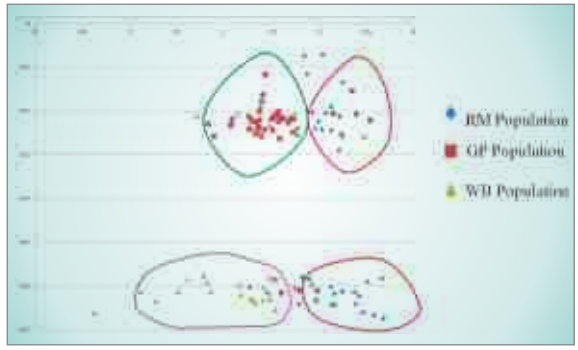


Fig. 14. Structural variation based on 10 ordine points from three tilapia populations showing phenotypic variation.

Gel beads produced through reverse spherification technology

A Prototype tilapia hatchery was established and monosex tilapia produced

A new tilapia hatchery has been developed and made functional during the period under report. This hatchery is believed to be one of the best in India where breeding programmes can be undertaken for variety development and also for production of monosex population. This has inbuilt filtration system where water circulation is automatic and reuse of water is possible. In the first batch of monosex (male) production, all water parameters and masculinization protocols were standardized.

Inside view of the tilapia hatchery at ICAR-CIFA, Bhubaneswar

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. Routray, S. K. Sahoo, Rajesh Kumar and U. L. Mohanty

Fish gel has high concentration of protein containing all the essential amino acids. It has an elastic textural characteristic of natural muscle tissue. Prawn larvae food should be perceived, captured, accepted and efficiently ingested by the larvae. Trial has been conducted in *Channa striatus* & *Clarias batrachus* larvae to observe the ingestion, assimilation, growth and survival of these larvae (Table 7).

Table 7. Physico-chemical properties of fish gel dispersion

Gel dispersion	Rohu	Catla	Pangas	Silver carp	Murrel
Viscosity (cP)	3700	3100	3232	2761	4200
Protein (g/kg)	24.8	19.0	19.5	18.5	26.4
Cookloss (%)	1.09	2.32	1.02	1.2	0.85
pH	3.54	3.56	3.76	3.47	3.80
Titrable acidity (ml)	1.14	1.05	1.20	1.30	1.08

Fish gel sticks technology for larval feeding

Rural women of ornamental fish village

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

Demonstration programme for technology transfer

Base line survey was done for a new village called Nuagaon to assess their socio economic status.The success of Landijhari and Saruali villages influenced the farmers of Nuagaon. Out of 16 farmers adopted 70% are women and 30% of the total women farmers are unemployed involved in income generation by utilizing their leisure time. Each beneficiary has constructed 4-8 tanks of 300-400 l capacity (14-16 cubic ft.) in their backyard. A woman SHGs is involved in aquarium making. Social and financial inclusion of women farmers through group approach was achieved. Generated an average income of Rs 8000-12000/8 months with an investment of 4-6000/farmer. Linkage established with state administration for setting up a field laboratory and construction of new concrete tanks.

Input distribution like FRP tanks and other accessories have been made to selected 50 farmers of Landijhari, Saruali and Nuagaon for production of livebearers which enhanced their income up to 30%.

Innovations

- The ornamental fish marketing hub also enriched with FRP tanks and other accessories with the funding from NAIP livelihood helped proper storage and marketing of produce.
- Management of livebearers during monsoon and winter season as advised by the Institute could restrict the mortality.
- Programme was implemented in cluster approach for experience sharing and mutual help which further resulted in specialization and the mass scale production has attracted the traders for onsite trading and reduction of hazards of transportation.

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, S. K. Sahoo, B. B. Sahu, C. K. Mishra, K. Murmu, Rajesh Kumar, N. K. Barik, S. Sarkar, P. K. Meher, S. Ferosekhan, P. Jayasankar, Anantharaja K., U. L. Mohanty, N. Panda, D. P. Rath and B. D. Mishra

FRP carp hatchery demonstration to tribal farmers

Through demonstrations during the monsoon period of 2014, total 92.0 lakh carp spawn was produced in the FRP carp hatchery installed at Subarnapur Village, Gop Block, Puri District of Odisha; 7.0 lakh spawn at Muniguda, Rayagada District of Odisha and 4.0 lakh spawn at Bali Island, Sunderban, West Bengal. Specifically at Bali, during 5-7 August 2014, induced breeding trials were undertaken for *Labeo rohita* in FRP carp hatchery and *Labeo bata* in hapa.

Aquaculture demonstration in Dahod District, Gujarat

The 22 farmers under SHGs were selected for adoption in the district. Critical inputs were supplied to them for initiation of aquaculture programme in the ponds. One FRP carp hatchery was supplied to Anand, Gujarat for demonstration to farmers.

Preliminary information of fish farming practices by the tribal fish farmers of the district of Dahod and Panchmahal in Gujarat has been collected. The problems and needs of the tribal fish farmers have been documented. Participatory technology dissemination on carp polyculture in the district of Dahod of Gujarat has been carried out under TSP (Tribal Sub Plan) Project. Two groups of tribal fish farmers (22 persons) of Garbada Block and Jalat block of Dahod district, Gujarat have been provided technical support for carp polyculture. Periodic netting was done to measure the fish growth and accordingly feed rations were suggested. A method demonstration was conducted on brood stock management and induced breeding of Indian major carp at Rayanbadia village of Panchmahal district of Gujarat for the benefit of tribal fish farmers' community.

Carp breeding demonstration programme at Subarnapur, Gop, Puri District

Under TSP-CIFA, two trials of induced breeding of rohu were conducted at Subarnapur, Gop, Puri on 30 May and 3 June, 2014. In total 21.5 lakh spawn were harvested from two breeding trials. 25 farmers including 10 WSHG members were trained on identification of male and female brood carps, induced breeding and hatchery management. These spawn were distributed among the adopted farmers.

CIFA demonstration programme on integrated fish farming became the model for whole Sunderban Islands of West Bengal

In 2013, CIFA had initiated a massive demonstration programme through integrated aquaculture for livelihood development for the tribal people of Hathkhola Village, Bali Island, Sunderban, West Bengal. The outcome of the demonstration became a national example from TSP. During 23 and 24 April, 2014 the Principal Chief Conservator of Forest; Additional PCCF and Director, Sunderban Biosphere Reserve; Chief Conservator of Forest and Field Director,

Sunderban Tiger Reserve; and other forest officials of West Bengal had attended a Workshop-cum-Interactive Session with the beneficiaries of TSP-CIFA; and Bali Nature and Wildlife Conservative Society at Bali. Dr B.C. Mohapatra, Principal Scientist and Chairman, TSP-CIFA appraised the CIFA demonstration programme at Bali to the participants. Motivated with the success of TSP-CIFA, the Sunderban Biosphere Reserve in collaboration with CIFA has adopted two villages from the Sunderban fringe area for integrated fish culture programme. In a letter, Mr. Pradeep Shukla, IFS, APCCF and Director, Sunderban Biosphere Reserve has requested Dr. S. Ayyappan, Honorable Secretary DARE and DG, ICAR for implementation of ICAR programmes and for transforming technologies for development of various agriculture, aquaculture and the livelihood activities in other remote areas of Sunderban Biosphere Reserve.

Awareness programme on aquaculture for tribals of Puri District, Odisha

An awareness programme was conducted on 2 May 2014 for adoption of tribal farmers under TSP-CIFA for 45 women SHG members of two villages, Nigidi and Jaipur in Satyabadi Block of Puri District for their livelihood development through aquaculture and other allied agricultural activities.

Carp breeding and fish health management training at Bali, WB

A training programme on "Carp breeding and fish health management" was conducted at Bali Island, Sunderban, West-Bengal during 6-7 August 2014. Total 37 nos tribal beneficiaries of TSP-CIFA programme participated in it.

Awareness programme on aquaculture for tribals of Nayagarh District, Odisha

An awareness programme on aquaculture was conducted at Jamusahi Village, Daspalla Block of Nayagarh District, Odisha on 14 August 2014. Fifty farmers participated in the programme. One FRP hatchery has already been supplied to the village for carp seed production and for the benefit of the tribal people of the area.

Popularizing the feed based aquaculture in the farmer's field in Mayurbhanj District, Odisha

On 25 September 2014, a training programme on "Popularizing the feed based aquaculture in the farmer's field" was organized at Betnoti Block of Mayurbhanj District, Odisha. The program was attended by more than 100 farmers of the district.

Surveyed the fish farming practices that are followed by more than 50 tribal fish farmers of Betanoti Block of Mayurbhanj district and advised them how to carry out the scientific fish farming. Under TSP programme, distributed the two portable FRP carp hatcheries for the benefits of the tribal fish farmers of Biosi and Badasahi Blocks of Mayurbhanj district. Technical help was provided to members of the Nadpur Krushak Samaj for feed based aquaculture under TSP-Outreach Activity on Fish Feeds programmes of the Institutes and also organized a one day training programme on "Popularizing the Feed Based Aquaculture in Farmer's Field" at Betonati, Mayubhanj on 25/09/2014 in which about 100 tribal fish farmers participated. An exhibition-cum-hands on training was also organized on "Feed and Feeding of Fish" covering the aspects of common fish feed ingredients used for preparing the fish feed, machineries used for farm made feed preparation, procedure for farm made feed preparation and their storage, feeding schedules and feed dispensing methods.

FRP carp hatchery commissioned at Wyanad, Kerala

A portable FRP carp hatchery unit has been commissioned at Karapuzha Reservoir, Wyanad District, Kerala. On 29 September 2014, the hatchery handing programme was organized at

Karapuzha Reservoir, Wayanad, in which the Hon'ble MLA was the Chief Guest. Dr P. Jayasankar, Director, CIFA; Dr N. Sridhar, SIC, RRC of CIFA, Bangalore; SIC, CIFRI, Bangalore; Jt. Director, Kerala Fisheries Dept.; ADF, Wayanad; Dist Public representatives, Karapuzha Reservoir Fisheries Society members participated in it.

FRP Carp Hatchery inauguration and workshop for tribal farmers held at Gop, Puri District of Odisha on 1 November 2014

One day workshop on "Quality Carp Seed and BMP for Enhancement of Aquaculture Production" was organized by ICAR-Central Institute of Freshwater Aquaculture under its TSP project at Subarnapur Village, Gop Block of Puri District, Odisha. The FRP carp hatchery which was commissioned by ICAR-CIFA in the Sahoo Fish Farm of Subarnapur village was inaugurated during the workshop. A leaflet on Sahoo Fish Farm success story was also released in the workshop. The FRP hatchery and its implements were displayed to the public.

Training programme sponsored by 12th Battalion, the Mahar Regiment, Indian Army under TSP

A training programme on "Freshwater aquaculture as a livelihood option for tribal farmers" for the unemployed tribal youths of Assam was organized at ICAR-CIFA, Kausalyaganga from 2-5 December, 2014. The programme was sponsored by 12th Battalion, The Mahar Regiment, Indian Army. In this programme 60 tribal youths got trained in new techniques of freshwater aquaculture practices.

National Day for Women in Agriculture celebrated at ICAR- CIFA

The National Day for Women in Agriculture was organized by Krishi Vigyan Kendra, Khordha, ICAR- CIFA on 5th December, 2014 under Tribal Sub Plan programme of ICAR- CIFA. The main aim of the programme is to empower women to defeat hunger and to emphasize on the role of women in agricultural development. More than 200 women fish farmers from Tangi, Begunia and Bhubaneswar Blocks had participated in the programme.

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 P. L. Lalrinsanga

A total of 20,000 seed of 6th generation of genetically improved scampi 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. A new experimental freshwater prawn hatchery was established at the same site as that of broodbank and trial seed production cycle was started in March 2015. As demand of scampi seed has increased in 2014, some private hatcheries have approached the scampi broodbank for broodstock.



Project Title	:	Carp seed production in FRP hatchery and development of integrated rearing system for livelihood development of SC/ST communities in Khordha District of Odisha
Project Code	:	E-88
Funding Agency	:	DBT, Govt. of India
Duration	:	July, 2014-July 2017
Project Personnel	:	B. C. Mohapatra (PI), N. K. Barik and P. R. Sahoo

In Khordha District, in Balipatna, Banapur and Begunia C.D. Blocks, the survey of SC/ST beneficiaries and ponds was undertaken with the help of KVK (Khorda), Odisha; State Fishery Department and CARD, Bhubaneswar for selection and implementation of the project mandate. Three FRP carp hatchery units were fabricated at ICAR-CIFA for installation in those Blocks of the district. Total number of farmers and ponds selected as on 31 March 2015 is given in Table 8.

Table 8.

Block	Selected village	No of beneficiaries	No of ponds	Area of ponds (ha)
Begunia	Govindpur	50	4	2.0
	Kantabada	15	3	0.6
Banapur	Niladriprasad G.P.	List reached for 3047 ST & 703 SC households for selection	To be decided	To be decided
Balipatna	Narada	30	4	2.0
	Puranapradhan (Sisilo)	10	To be decided	To be decided

B. Fish Genetics and Biotechnology

Project Title	:	Genetic upgradation of freshwater fish and shellfish
Project code	:	I-59
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

Production of fullsib families of catla

For the first time in India catla selective breeding was initiated with 50 fullsib families (generation-1) from eight stocks of base population. Wide range of variation observed among and between stocks. Egg colour variation was also observed in different stocks of catla reared in same communal pond. All the fullsib families were reared in nursery ponds and tagging was standardized for catla with PIT tag. Tagging completed and 608 numbers of catla stocked in one monoculture and one polyculture pond along with improved rohu for further growth evaluation.

Field evaluation of generation-1 catla

The 34 lakhs of generation-1 catla supplied to different parts of India like Assam (Tata Amalgamated LTD), Bihar, West Bengal, Tamil Nadu, Gujarat, NFFBB, Kausalyaganga, Odisha fish farmers, and CIFA farm for field evaluation.

2014 year class "Jayanti rohu" production and dissemination

During 2014, 61 fullsib families of improved rohu produced and reared in nursey ponds for taggable size. Tagging was completed for 52 fullsib families and stocked in two monoculture and one polyculture ponds for further growth evaluation. During the year, 334.75 lakhs of improved rohu "Jayanti" was produced apart from fullsib families. Under dissemination of improved rohu program, 299.5 lakhs of improved rohu seeds were disseminated to different states/Institutes like Assam, Bihar, West Bengal, Odisha, Gujarat, CIFA farm, KVK, CIFA and NFFBB, Kausalyaganga. Also, disseminated 8650 nos fry/ advance fingerlings to Gujarat, Manipur and Tamil Nadu. Gujarat reported higher survival of "Jayanti" in comparison to local rohu.

Sub-project	:	In vitro production of fertile sperms from the testicular cells of Clarias batrachus
Project Code	:	I-59 (m)
Funding Agency	:	Institute-based
Duration	:	April 2012 – March 2015
Project Personnel	:	H. K. Barman (PI), J. N. Saha and S. K. Sahoo

In continuation with the previous year, the successful enrichment of the magur SSC was carried out. After remaining 2 months in culture condition, the self-renewing population of magur spermatogonial cells produced motile sperms (in tune of 7×10^4) in vitro through differentiation process (Fig. 15). The in vitro produced sperms are motile in nature and free swimming inside the flask containing media. The fertile nature of the in vitro produced sperms is yet to be verified. For the purpose of genotypic and phenotypic signatures, attempts were made to clone and characterize of another known SSC marker gene, such as *GfrA1* of catfish. About 1189bp of partial nucleotide sequence of *gfrA1* was obtained. The heightened mRNA expression levels of *Pou2* and *Plzf* in enriched SSCs was documented (Fig. 16). So, the cells were undifferentiated in nature. The enriched spermatogonial cells were $Plzf^+$ gfr^+, $pou5f1^+$ indicating their undifferentiated properties.

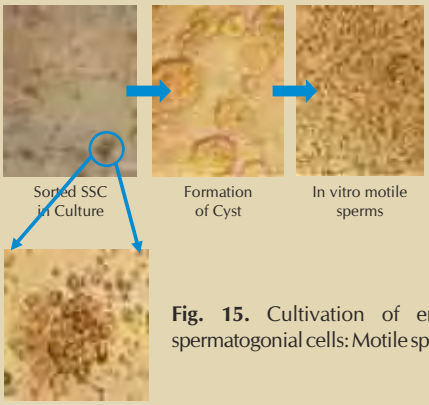


Fig. 15. Cultivation of enriched spermatogonial cells: Motile sperms

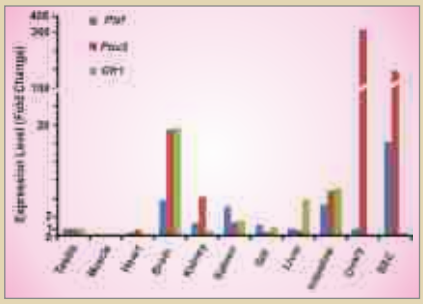


Fig. 16. q RT-PCR for gene expression study of C. batrachus. The heightened mRNA expression levels of Pou2 and Plzf in enriched SSCs.

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 2016
Project Personnel	:	S. Nandi (PI), P. K. Meher, J. K. Sundaray, P. Das, P. Routray and D. K. Verma

Digital gene expression profile during preparatory and post-spawning phases in rohu

Assembly of high quality Next Generation sequences data was carried out in CLC bio workbench as well as velvet/oases programmes and analyzed both in reference and *de novo* based approaches. In reference based analysis, the zebrafish (*Danio rerio*) has been taken as model species for being under Cyprinid family. Comparative Digital Gene Expression study using the NGS data of the two phases (i.e. winter and summer) showed 1855 and 1840 unigenes in brain; 1485 and 890 unigenes in liver; 2173 and 1011 unigenes in ovary and 1997 and 1618 unigenes in pituitary tissue which were up and down regulated respectively during summer (preparatory) as compared to winter (post spawning) and the differences were statistically significant ($p < 0.05$). Besides, number of unigenes expressed only during summer in brain, liver, ovary and pituitary were 9185, 4756, 4744 and 4695 as compared to 4052, 834, 6995 and 1633 unigenes found exclusively during winter phase in the respective tissues (Table 9). Out of the four tissues, the least fold changes was observed in pituitary in HT-map analysis constructed with known transcripts (Fig. 17). Further analysis in *de novo* also revealed that the top 100 unigenes in each tissue showing higher up or down regulation between the two phases are either unknown (not matching in any database) or uncharacterized so far. On the other hand, differential gene expression profile in reference based analysis over all showed maximum number of transcript up regulated in ovary and down regulated in brain. Out of 15523, 16722, 8333 and 9930 transcripts in brain, ovary, liver and pituitary; 3732, 14752, 3332 and 5938 were up regulated and 11791, 1970, 5501 and 3992 were down regulated in respective tissues.

Table 9. The comparative ht-map of the two phases for the known sequences shows more up and down regulation in BR, LIV and OVA and the least in PIT

DGE Statistics of De-novo Analysis												
Total unigenes Available	**185571**											
Samples	**BR**			**LIV**			**OVA**			**PIT**		
Noi.of unigenes in cont (winter) and treat (summer) sample	TOTAL	UP	Dn	TOTAL	UP	Dn	TOTAL	UP	Dn	TOTAL	UP	Dn
Noi.of unigenes expressed in both samples	126809	26427	24344	77748	15635	13276	105858	26371	21057	118131	16495	16011
Noi.of unigenes expressed only in control sample	4052	NA	NA	834	NA	NA	6995	NA	NA	1633	NA	NA
Noi.of unigenes expressed only in treated sample	9185	NA	NA	4756	NA	NA	4744	NA	NA	4695	NA	NA
No.of P-significant unigenes ($p < 0.05$)	3695	1855	1840	2375	1485	890	3184	2173	1011	3615	1997	1618

Brood stock of *Labeo bata*

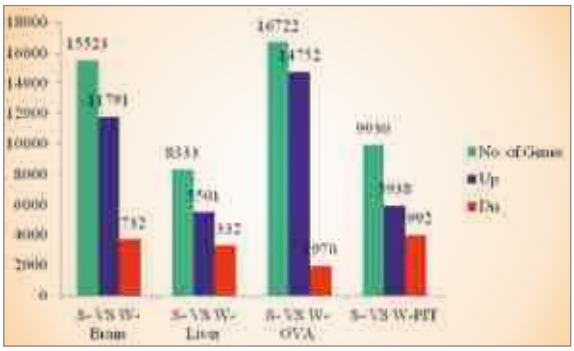


Fig. 17. Tissue-wise distribution of up and down -regulated significant genes analysed by reference approach

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. Detection of proteins in the 2D gels was carried out by scanning the gel in ImageScanner III. The gel images of control and treated groups were compared and analyzed by the ImageMaster 2D Platinum 7.0 software. Three replicates of each 2D-gel were analyzed together for image analysis. Protein spot differences were analyzed based on ANOVA statistical test with p value less than 0.05 and a fold change of more than 1.5 intensity, and 30 differentially expressed proteins were detected. Experiments are in progress to identify these differentially expressed proteins.

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

Mass breeding was performed for the *Labeo bata* stocks collected during 2013-2014 and the offspring reared in the nursery pond. In addition to breeding, the genetic characterization of stocks has also been carried out. In an attempt to characterize the Jobra stock, 8 rohu microsatellite loci was cross amplified in *Labeo bata*. Out of 8 loci, 5 were successfully amplified in bata and used for genetic variation study. High within population genetic diversity was observed in Jobra stock.

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 and L. Sahoo

Approximately 150 live mrigal samples from river Ganga were collected and reared in nursery ponds. In addition to collection of live mrigal specimens sampling and tagging of previous year collected mrigal stocks were performed. Statistical analysis of weight data of different mrigal stocks exhibited

significant difference. Further, DNA from ~200 individuals belonging to different mrigal stocks were isolated and checked for quality and quantity on 0.8% of agarose gel.

In addition to above mrigal stocks were reared in communal ponds were sampled and the variation in body weight at 130 days was analyzed using Generalized least square mean for presence of significant variation in the weight (Fig. 18).

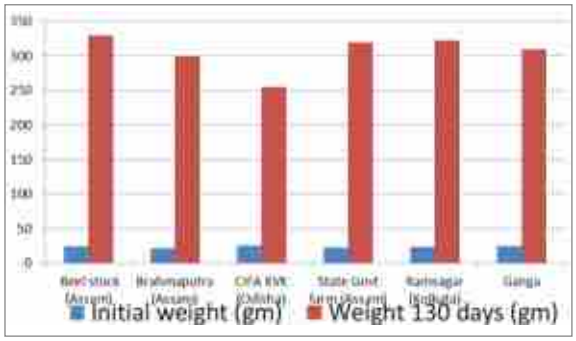


Fig. 18.

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

Towards developing marker database in catla, next generation sequencing on Illumina Nextseq500 platform generated ~10 GB of paired end data. The raw reads were pre-processed and assembled using the software CLC genomics workbench version 7.0 resulting in 6,97,565 contigs. The contigs were screened for presence of simple sequence repeats (SSR) using the program microsatellite identification tool. In total, 103625 microsatellites repeat motifs were identified out of which 56834 were di-nucleotide, 26993 tri-nucleotide, 14632 tetra-nucleotide, 5075 penta-nucleotide and 91 were hexa-nucleotides (Fig. 19). Primers were designed successfully for 50168 microsatellite loci.

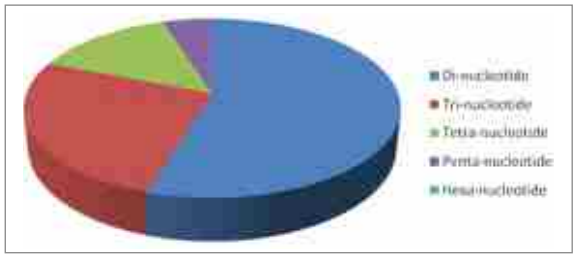


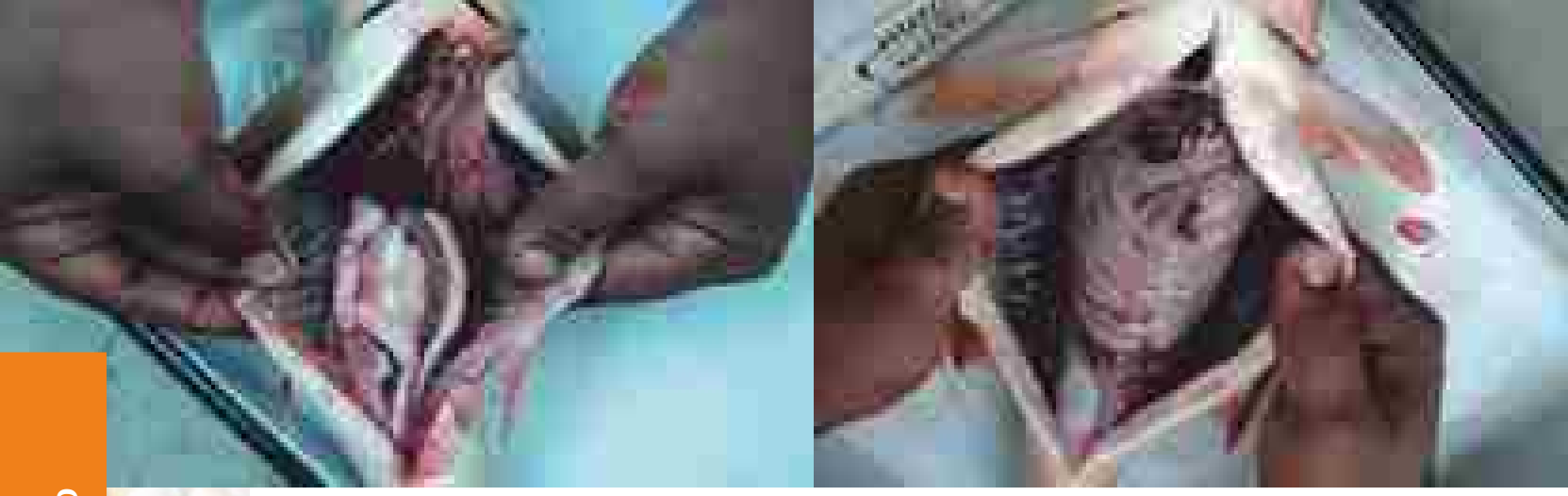
Fig. 19. Distribution of microsatellite repeats motifs in *Catla catla*

Single nucleotide polymorphism markers were identified by mapping the raw reads to the contigs and quality based variant calling was done with following criteria: minimum variant-4, central quality-30, neighborhood quality-20 etc. Altogether, 20,000 SNPs were identified.

Three F1 mapping families (CF1, CF2 and CF22) were produced by crossing individuals collected from 6 different locations. Fin clipping was done from fingerlings (about 200) from these families.

Sub-project	:	Development of single nucleotide polymorphism in Labeo rohita and *M. rosenbergii*
Project Code	:	I-59 (S)
Funding Agency	:	Institute-based
Duration	:	April 2013 – March 2016
Project Personnel	:	P. Das (PI), Laxman Sahoo, J. K. Sundaray, K. Murmu and P. L. Sanga

Sampling and tagging of different mrigala stocks



Gonads of females

Double digested restriction associated DNA sequencing approach was employed to develop SNPs in two commercially important finfish and shellfish species e.g. *Labeo rohita* and *M. rosenbergii*. Parents of linkage mapping panels of both the species along with their F1 offspring (92 each) were used for high throughput sequencing in Illumina-Hiseq 2000 which resulted in 143.7 million reads. Single nucleotide polymorphisms was identified by mapping the reads of father to the contigs generated from the reads of the mother using CLC bio genomics workbench version 7.0.4. In total, initially 2, 03,560 SNPs were indentified in rohu. Similarly, 199.5 million reads were obtained in giant freshwater prawn and 2, 61,445 SNPs were identified following the procedure employed in rohu. Further, to enrich the SNPs database in rohu, 162 tissues from 18 individuals (9 each group) were collected from growth selected and un-selected fish. Three cDNA libraries were prepared and sequenced on Illumina Nextseq-500 platform.

Sub-project	:	Effect of CIFABROOD™ on the breeding performance and seed quality of Jayanti rohu (Labeo rohita)
Project Code	:	I-59 (T)
Funding Agency	:	Institute-based
Duration	:	April 2014 – March 2017
Project Personnel	:	J. N. Saha (PI), S. Nandi, K. D. Mahapatra, K. Murmu and J. K. Sundaray

During 2014-year breeding season, 6 fullsib families of 2014-year class were produced from the brood fishes (2012-Year class) of experimental ponds. Percentage of fertilization of each fullsib family was found to be more than 90%. Diameter of swelled eggs was measured individually for all the 6 families. It was in the range of 4.01 to 5.11 mm with an average of 4.43 mm. No breeding programme was undertaken from the brood fishes of control ponds due to improper maturation.

During the month of August 2014, the brood fishes from both the sexes were sacrificed and observed that fishes were in regression phase. The male testis was found to be very thin, not in a milting condition. In female, there was no egg. We observed that due to late feeding of CIFABROOD™ the desired effect of feed on prolonged maturation could not be achieved.

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 – March, 2015
Project Personnel	:	H. K. Barman (PI), J. N. Saha and K. D. Mahapatra

In order to understand the mechanistic pathways of Pou2 gene in spermatogonial stem cells, it is essential to transfect DNA into spermatogonial cells. Unlike in other stable cell lines, the DNA transfection protocol for fish spermatogonial cells is still lacking. To optimize the transfection protocol for the rohu spermatogonial cells, we performed the commercially available various Lipofectamine. Unfortunately, we could not succeed to transfect a DNA construct (GFP expressing vector driven by the rohu β-actin promoter). Subsequently, we attempted electroporation using Neon transfection system (In-vitrogen) via the combination of three electric parameters, namely the electric field (voltage), pulse width and pulse number. We could

successfully optimized the nucleofection parameters to transfect above mentioned vector DNA into proliferating rohu spermatogonial cells. As shown in Fig. 19 and Table 10, nucleofected (with 3 pulses at 1300 volts and 0 widths) spermatogonial cells efficiently expressed GFP protein. On average, 76±2.18% cells could efficiently be transfected with 92±0.88% cell viability, which includes both transfected and non-transfected cells and 57±1.66% GFP positivity (Table 10), which indicates a higher rate of efficient transfection. GFP expression was also documented after 60 days of cultivation of transfected cells. Thus, it was possible to successfully transfect undifferentiated proliferating rohu spermatogonial cells.

Table 10. Tali Image-based readings of transfected cell lines (72 h post-transfection), showing the percentage of cells expressing GFP including cell viability (average of three independent experiments, each in triplicate). Data are presented as mean ± standard error (SE).

Cell Type	Total GFP/Transfection efficiency (%)	Live GFP (%)	Dead GFP (%)	Total Viability (%)
Spermatogonial cell	76 ± 2.18	57 ± 1.66	19 ± 1.76	92 ± 0.88
HEK293	72 ± 1.15	68 ± 3.52	4 ± 2.90	97 ± 1.45
K562	83 ± 1.45	75 ± 4.35	8 ± 2.90	94 ± 1.76
SF21	68 ± 0.81	52 ± 2.40	16 ± 2.60	90 ± 0.57

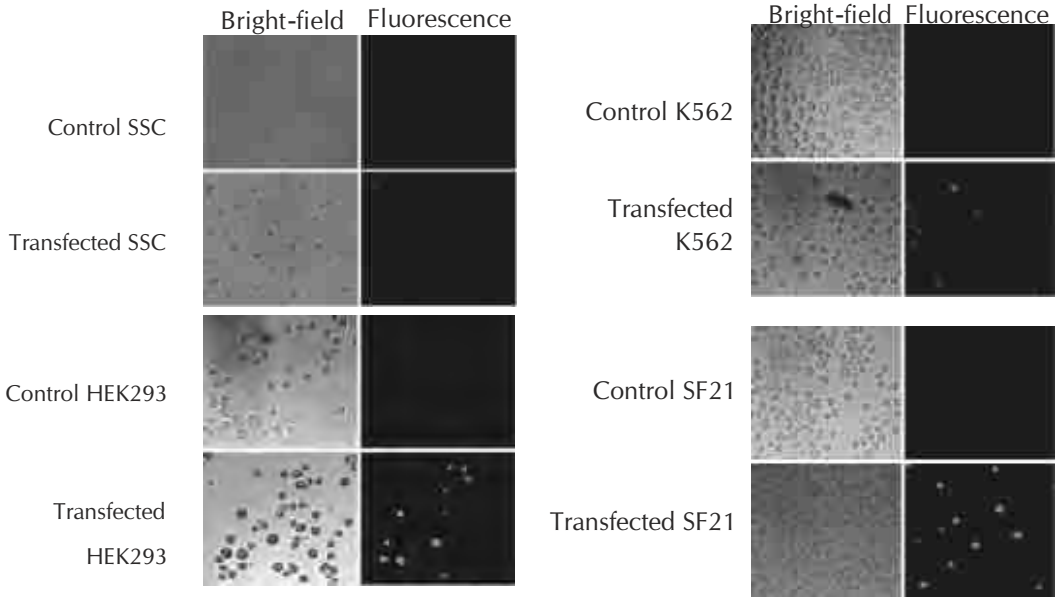


Fig. 20. GFP expressions in various cell lines driven by the β-actin promoter. Documented expressions in rohu spermatogonial, HEK293, K562 and SF21 cells. The left panel shows the bright-field view, and the right panel represents the fluorescent view

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

In order to develop species specific molecular signatures at population level, the microsatellite markers developed earlier for *Labeo rohita*, were cross amplified in catla and mrigal. Four loci which showed amplification in IMCs were used. Ten individuals from each species along with rohu X catla hybrid were genotyped. Structure analysis of the genotyping data of three Indian major carp species and rohu X catla hybrid were clearly delineated from each other (Fig. 20).

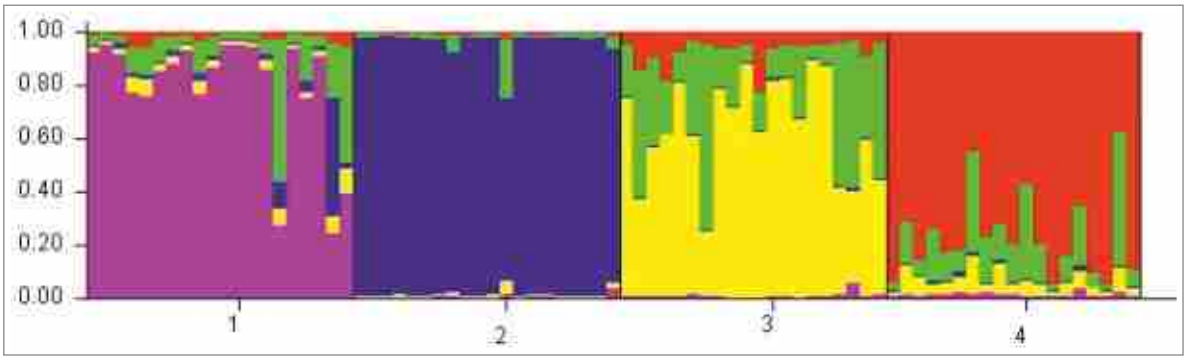


Fig. 21. Population 1: Labeo rohita, population 2: rohu x catla hybrid, population 3: *Catla catla*, population 4: *Cirrhinus mrigala*

Project Title	:	Development of a protocol for targeted integration of genes in catla *(Catla catla)*
Project Code	:	E-77
Funding Agency	:	NFBSFARA
Duration	:	June, 2012 to March, 2015
Project Personnel	:	H. K. Barman (PI), P. Jayasankar, K. D. Mahapatra, J. N. Saha and P. K. Meher

We designed and synthesized the two DNA oligonucleotides for each target that are sense and antisense sequences of the target DNA, spanning 20 bp upstream of the protospacer adaptor motif (PAM) using the tool of CAS900A-1 as per SBI user manual. For the HR vector, the sizes for homology arms varied between 0.5 kb to 1kb for each arm for efficient recombination to occur. For Cas9 system, the cleavage site is 2-3 bp upstream of the PAM immediately following the guide RNA sequence, and accordingly the final targeting HR vector constructed using MCS1 and MCS2. The correctness and orientations were validated by bidirectional sequencing. This Cas9 nuclease system along with the HR donor vector bearing homology arms were co-injected (micro-injected) into fertilized embryos of catla and rohu for gene integration experiments. In other experiments, these two vectors were electroporated into sperms followed by fertilization with normal eggs (female). Microinjection of Cas9 nuclease into one/two-cell rohu embryos led to site-specific indels, which were confirmed by SURVEYOR assay. The TLR22 gene of rohu was PCR amplified and digested with SURVEYOR Nuclease S followed by resolving through 5% polyacrylamide gel in 1x TBE. Two injected individuals (out of seven individuals) generated expected digested bands, but not in control individuals, demonstrating about successful modification at a precise/desired site by non-homologous end repairing. These results are now being confirmed by Sanger sequencing method. Analyses of full-length mRNA expression revealed that mutant individuals lacked TLR22 gene expression (Fig. 21).

Electroporation (for sperm) mediated gene delivery also successfully disrupted rohu TLR22 gene by homologous recombination. This was confirmed by amplifying genomic DNA and sequencing of amplified fragments. The vector DNA sequence (expression cassette of RFP, red fluorescence protein) was inserted within the TLR22 locus (data not submitted). This was confirmed by documenting RFP expression in positive individual (Fig. 22). Further, the findings are confirmed by Southern Blotting. Gene edited/disrupted catla individuals are yet to be analysed.

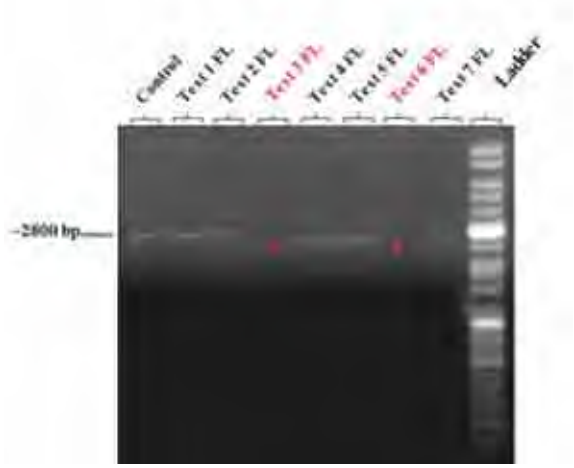


Fig. 22. Gel electrophoresis (1.2% Agarose) analysis of mutants using corresponding cDNA as template revealed that lacks rohu tlr22 full length 2800 bp in mutants (positive by Surveyor mutation assay).

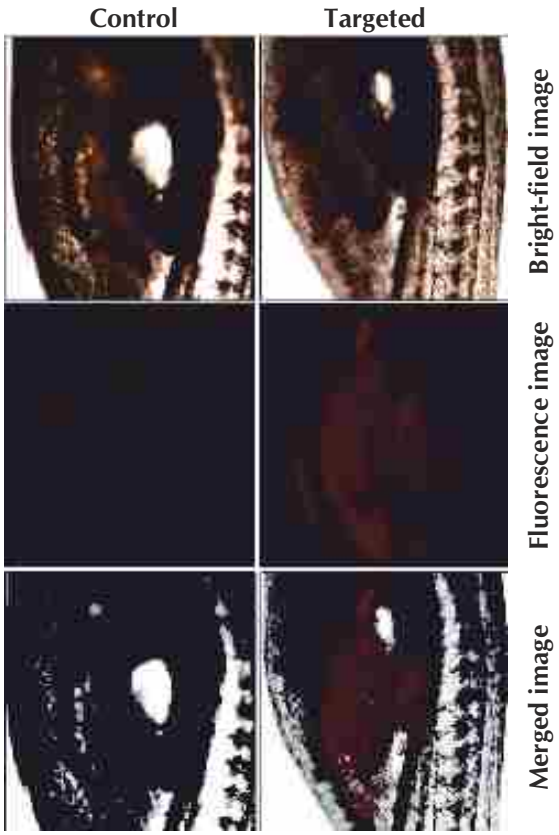


Fig. 23. RFP expression in TLR22 disrupted rohu fry.

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

ICAR-CIFA has supplied 8.0 lakhs of "Jayanti rohu" and 2.75 lakhs of catla (generation-1) to NFFBB, Kausalyaganga for further rearing and dissemination.

Under this NFDB funded project, in collaboration with NFFBB, 51,300 numbers of improved rohu "Jayanti" and catla (generation-1) fingerlings was supplied to 8 states like Karnataka, Tamil Nadu, Maharashtra, Odisha, Andhra Pradesh, Telengana, Gujarat and Nagaland. Minor carps i.e. *L.gonionotus* and *L. calbasu* seed were also disseminated to Karnataka. On-farm evaluation of G5 freshwater prawn is under progress at NFFBB. Selected Generation-4 freshwater prawn brood fishes were supplied to two hatcheries for stock improvement program. Carp as well as prawn hatchery survey is under progress at West Bengal and Odisha.

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

Sequencing of rohu genome was performed employing a combination of next generation sequencing platforms such as Roche, Illumina and Ion Torrent. In total 154.5 GB of sequence data with ~110X coverage was produced. Out of this data, the Illumina Nextseq500 platform alone produced 145 GB of sequence data. *De novo* assembly is in progress by evaluating different software. Data produced by 454 GS FLX platform (5GB) was analyzed using CLC Genomics Workbench (Version 7.0.4) software for development of molecular markers such as SNPs and simple sequence repeats (SSR). Raw reads were preprocessed and trimmed and assembled *de novo* using the above mentioned program. In total 1, 206,684 contigs were generated by assembling 5,824,666 high quality reads. The largest contig (16,606 bp size) obtained had 100% homology with the complete mitochondrial genome of rohu. Single nucleotide polymorphisms were detected using quality based variant method as employed in CLC genomics workbench and 46,173 high quality heterozygous SNPs were obtained after applying various filtration criteria. Similarly, 39,742 SSRs were detected from 30,709 contigs with contig sizes ranging from 500 to 800 bp using MISA software. Among the identified SSRs, di-nucleotide (59%) was the most common repeat motif followed by the tri- (20%), tetra- (17%), penta- (4%) and hexa- (0.67%) nucleotide (Figs. 23&24). Primers for 1044 potential SSR motifs were designed for their evaluation in the existing reference population. Further, 67.98 GB of sequence data has been produced employing Illumina Miseq platform making the total genome coverage more than 150X.

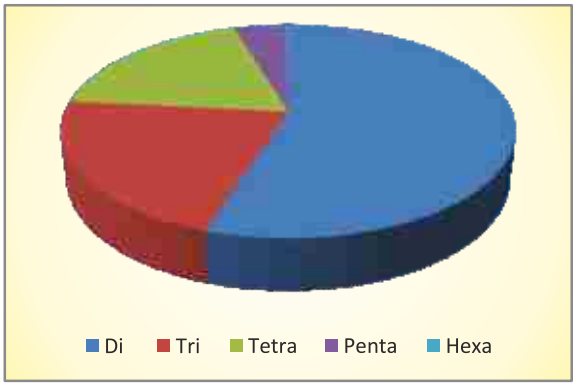


Fig. 24. Percentage of different types of repeats

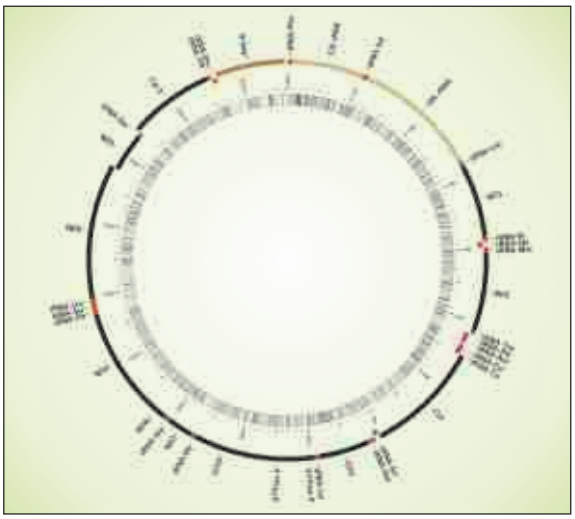


Fig. 25. SSR markers

OUTREACH PROJECT

Project Title	:	Outreach activity on Fish genetic stock
Duration	:	2014 – 2017
Funding Agency	:	ICAR-Network mode
Project Personnel	:	P. Das (PI), P. Jayasankar, J. K. Sundaray, L. Sahoo and S. K. Sahoo

Exploratory survey to Sambalpur was undertaken to assess the availability of assigned species e.g. *Tor khudree, Pangasius pangasius* and *Heteropneustes fossilis*. Data analysis work left over from previous phase on IMCs and *Labeo fimbriatus* was completed and final report submitted. Morphometric analysis of all the IMCs did not reveal any stock structure, but *L. fimbriatus* showed differentiation among Peninsular region. Genetic structure analysis using DNA markers showed that the main source of genetic variation was within populations rather than among populations of IMCs. In summary, IMCs of all the Peninsular rivers showed population admixture as they evolved from common ancestor during same period throughout the Peninsular region and Mahanadi river was found to be the most ancestral among Peninsular riverine systems with respect to IMCs. However, *L. fimbriatus* revealed population genetic structure among those rivers.

C. Fish Nutrition and Physiology

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, Saroj Toppo, S. Adhikari, B. B. Sahoo, S. C. Rath, S. Mohanty,Gangadhar B, B. N. Paul, K. N. Mohanta, K. C. Das, S. Sarkar and S. K. Nayak

Sub-project	:	Macronutrients requirement of the Peninsular carps *Puntius carnaticus* fingerlings
Project Code	:	I-85(a)
Funding Agency	:	Institute-based
Duration	:	April 2013 – March 2016
Project Personnel	:	N. Sridhar (PI) and Gangadhar B.

Fingerlings of *P. carnaticus* of average initial length of 6.40 ± 0.267 cm and weight of 2.46 ± 0.39 g stocked in 15 aerated plastic tubs (40 litre), 12 each. Five test feeds were formulated containing 25 to 45% crude protein using pure ingredients such as casein, gelatine, dextrin, carboxy methyl cellulose, cellulose and agar. Initially, the experimental feed was given at 5% of the biomass and gradually adjusted based on the observation of daily feed consumption. The fish were allowed to feed for 6 hours. The feeding trial was conducted for a period of 60 days. Proximate composition of feed (Table 11) and carcass (Table 13) were determined. At the end of the experiment, the length and weight of the fishes were recorded. Weight gain FCR, specific growth rate and protein efficiency ratio for each feed were calculated (Table 12).

The growth parameters, FCR and PER were higher in Diet 3 with 43% carbohydrate level. Carcass proximate composition revealed lower moisture and higher crude protein and fat content in fish fed 43% carbohydrate level. Dry matter, fat and carbohydrate digestibility of experimental diets was also high in 43% carbohydrate. The study indicated a carbohydrate requirement of about 43% for *P. carnaticus* fingerlings.

Table 11. Chemical composition of test diets

Proximate Composition	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Moisture	1.04 ± 0.03	1.62 ± 0.10	1.31 ± 0.35	1.0 ± 0.02	1.67 ± 0.07
Crude Protein	35.77 ± 0.11	35.59 ± 0.67	36.14 ± 0.52	34.53 ± 1.03	34.06 ± 0.82
Fat	7.66 ± 0.02	7.30 ± 0.08	7.10 ± 0.04	7.56 ± 0.23	7.07 ± 0.07
Ash	6.13 ± 0.06	6.18 ± 0.02	6.29 ± 0.06	6.98 ± 0.03	6.05 ± 0.03
Crude fibre	11.95 ± 0.23	8.19 ± 0.01	3.42 ± 0.09	2.50 ± 0.03	0.41 ± 0.03
NFE	35.51 ± 0.31	39.11 ± 0.92	43.72 ± 0.61	47.43 ± 0.94	50.71 ± 0.90

Table 12. Growth parameters of *P. carnaticus* under different test diet

Growth Parameters	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Initial weight(g)	7.57 ± 0.10	7.59 ± 0.18	7.48 ± 0.12	7.59 ± 0.15	7.57 ± 0.06
Final weight(g)	9.51 ± 0.29^{a}	9.96 ± 0.14^{ab}	10.52 ± 0.08^{c}	9.38 ± 0.13^{a}	9.12 ± 0.14^{a}
Weight gain(g)	1.94 ± 0.33^{a}	2.37 ± 0.32^{ab}	3.04 ± 0.20^{b}	1.79 ± 0.20^{a}	1.55 ± 0.18^{a}
Specific growth rate(%)	0.38 ± 0.06^{a}	0.45 ± 0.06^{ab}	0.57 ± 0.04^{b}	0.35 ± 0.04^{a}	0.31 ± 0.03^{a}
FCR	3.47 ± 0.64^{ab}	3.00 ± 0.38^{a}	2.63 ± 0.17^{a}	4.54 ± 0.48^{bc}	5.27 ± 0.61^{cd}
PER	0.36 ± 0.06^{a}	0.47 ± 0.15^{ab}	0.67 ± 0.04^{c}	0.42 ± 0.10^{a}	0.54^{a} ± 0.14^{a}

Table 13. Whole body chemical composition of *P. carnaticus* reared under different test diets.

	Carcass composition (% on wet weight basis) of *P. carnaticus*				
Carcass Composition	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Moisture	73.49 ± 0.57^{c}	75.16 ± 0.32^{e}	72.72 ± 0.24^{a}	73.44 ± 0.36^{b}	73.86 ± 0.42^{d}
Crude Protein	18.68 ± 0.21^{b}	19.24 ± 0.28^{c}	19.31 ± 0.27^{c}	18.25 ± 0.12^{b}	17.36 ± 0.24^{a}
Fat	4.13 ± 0.01^{c}	3.82 ± 0.03^{b}	4.08 ± 0.11^{c}	3.50 ± 0.03^{a}	3.81 ± 0.02^{b}
Ash	3.46 ± 0.04^{a}	3.72 ± 0.08^{b}	3.66 ± 0.08^{b}	3.96 ± 0.07^{c}	3.84 ± 0.05^{bc}
NFE	0.25	0.05	0.23	0.84	1.13

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

Plant samples of natural growing and commercially available including floating plants, wetland plants, other leaves, concentrate feed ingredients seeds and cakes of conventional or nonconventional origin and pellet fish feed were used to determine for chlorophyll, lycopene, ß-carotene content and antioxidant property using 2-2 dipheny1-picryhydrazyl (DPPH) reducing ability. The effect on DPPH reducing ability by storage of aqueous extract, added moisture levels in feed mix and extrusion temperature during processing on antioxidant activity of pellet fish feed were studied.

In aqueous extract, duckweed chlorophyll content (63.7 mg/g) was more followed by wild colocasia, banana and marigold leaves (average 36.3 mg/g). Lower concentration of chlorophyll, lycopene and ß-carotene in oil cakes were observed except in mustard oil cake for ß-carotene (162 μg/g) and others were between (7 to 12 μg/g). Total beta-carotene and lycopene values in *Leucaena leucocephala* and wild colocasia were twice the value of duckweed (524.9 μg/g) and water hyacinth lamina (504.7μg/g). DPPH activity remains non-significant up to 90 days of storage in refrigerator. DPPH activity was similar in added moisture levels between 6-20% during pellet preparation. However, it decreased with increasing extrusion temperature beyond 160^{o}C. Present study indicated that floating plant are rich source of chlorophyll, ß-carotene and lycopene contents and their DPPH radical reducing ability were comparable with conventional oil cakes and feed ingredients.

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

Study the protein sparing effect of carbohydrate in carp using raw carbohydrate

A 60 days indoor experiment was conducted to examine the protein sparing effect of carbohydrate in improved rohu (Jayanti) fry (1.18-1.20 g). As

there is no literature available at present on protein (CP) and carbohydrate (CHO) requirement of Jayanti rohu fry, a control semi-purified diet (C) was prepared based on the optimum protein (40%) and carbohydrate requirement (26%) of normal rohu fry as reported earlier. Six semi-purified experimental diets were prepared using three sub-optimum levels of protein (30 and 35%) and three higher levels of carbohydrate (30, 34 and 38%) and the experimental diets are designated as C: 40% CP & 26% CHO; D-1: 30% CP & 30% CHO; D-2: 30% CP & 34% CHO; D-3: 30% CP & 38% CHO; D-4: 35% CP & 30% CHO; D-5: 35% CP & 34% CHO; D-6: 35% CP & 38% CHO. The 315 healthy and uniform sized pre-reared fry of Jayanti rohu was stocked in 21 FRP flow-through tanks of 100 l capacity each in triplicates for each diet. The fish were fed 5% of the body weight for the first month and 4% of the body weight or the second month. The fish were fed twice daily at 1000 and 1400 h in two split dosages and the unconsumed feeds were collected and the excreta removed. After 30 days of stocking, the fish were batch weighed to know the growth, survival and general health of the fish and the feeding ration was adjusted accordingly for the next 30 days. Except the water temperature which was measured twice daily, the other water quality parameters were measured and recorded in every 15 days interval. The experiment details and the results are given below (Tables 14-15):

Table 14. Growth and nutrient utilization of Jayanti rohu fed different levels of protein and carbohydrate

Parameters	Experimental diet						
	C (400 g CP, 260 g CHO)	D-1 (300 g CP, 300 g CHO)	D-2 (300 g CP, 340 g CHO)	D-3 (300 g CP, 380 g CHO)	D-4 (350 g CP, 300 g CHO)	D-5 (350 g CP, 340 g CHO)	D-6 (350 g CP, 380 g CHO)
Initial weight (g)	1.193 ±007^{a}	1.193 ±0.007^{a}	1.200 ±0.000^{a}	1.180 ±0.000^{a}	1.190 ±0.006^{a}	1.193 ±0.007^{a}	1.180 ±0.000^{a}
Final weight (g)	2.754 ±0.055^{bcd}	2.585 ±0.042^{d}	2.641 ±0.047^{cd}	2.590 ±0.114^{d}	3.002 ±0.089^{a}	2.883 ±0.002^{ab}	2.834 ±0.027^{abc}
Weight gain (g)	1.560 ±0.054^{bc}	1.392 ±0.045^{c}	1.441 ±0.047^{c}	1.410 ±0.114^{c}	1.812 ±0.084^{a}	1.690 ±0.024^{ab}	1.654 ±0.027^{ab}
FCR	1.667 ±0.026^{cd}	2.025 ±0.054^{a}	1.845 ±0.043^{bc}	1.887 ±0.118^{ab}	1.623 ±0.055^{d}	1.568 ±0.024^{d}	1.633 ±0.038^{d}
SGR	1.393 ±0.032^{bc}	1.288 ±0.032^{c}	1.314 ±0.030^{c}	1.307 ±0.073^{c}	1.541 ±0.041^{a}	1.470 ±0.017^{ab}	1.460 ±0.016^{ab}
PER	1.487 ±0.017^{b}	1.648 ±0.043^{ab}	1.809 ±0.042^{a}	1.780 ±0.115^{a}	1.765 ±0.060^{a}	1.822 ±0.029^{a}	1.752 ±0.040^{a}
PRE	25.443 ±0.44^{c}	28.267 ±0.63^{ab}	29.443 ±0.66^{ab}	29.533 ±1.86^{ab}	31.923 ±1.11^{a}	31.440 ±0.95^{a}	30.227 ±0.70^{ab}

Table 15. Whole body chemical composition (% dry matter) of Jayanti rohu fed different levels of protein and carbohydrate

Parameters	Initial	Experimental diet final						
		C (400 g CP, 260 g CHO)	D-1 (300 g CP, 300 g CHO)	D-2 (300 g CP, 340 g CHO)	D-3 (300 g CP, 380 g CHO)	D-4 (350 g CP, 300 g CHO)	D-5 (350 g CP, 340 g CHO)	D-6 (350 g CP, 380 g CHO)
Moisture	76.40 $\pm 0.10^{a}$	74.05 $\pm 0.09^{b}$	73.38 $\pm 0.15^{ef}$	73.99 $\pm 0.03^{bc}$	73.73 $\pm 0.02^{cd}$	73.25 $\pm 0.04^{f}$	73.57 $\pm 0.11^{de}$	73.33 $\pm 0.00^{ef}$
Crude protein	67.51 $\pm 0.06^{a}$	64.17 $\pm 0.35^{b}$	62.52 $\pm 0.50^{c}$	62.27 $\pm 0.09^{c}$	62.39 $\pm 0.29^{c}$	64.59 $\pm 0.36^{b}$	62.84 $\pm 0.38^{c}$	62.71 $\pm 0.47^{c}$
Ether extract	8.66 $\pm 0.10^{c}$	13.63 $\pm 0.19^{bcd}$	13.36 $\pm 0.08^{d}$	13.73 $\pm 0.09^{bc}$	14.58 $\pm 0.08^{a}$	13.41 $\pm 0.13^{cd}$	13.80 $\pm 0.08^{b}$	14.84 $\pm 0.08^{a}$
Total ash	12.89 $\pm 0.59^{a}$	9.56 $\pm 0.08^{c}$	10.48 $\pm 0.17^{bc}$	9.84 $\pm 0.60^{bc}$	9.27 $\pm 0.71^{c}$	9.61 $\pm 0.17^{c}$	9.33 $\pm 0.45^{c}$	11.19 $\pm 0.21^{b}$
Calculated digestible energy	3.920 $\pm 0.02^{d}$	4.295 $\pm 0.01^{abc}$	4.245 $\pm 0.01^{c}$	4.290 $\pm 0.02^{bc}$	4.355 $\pm 0.03^{a}$	4.285 $\pm 0.01^{bc}$	4.315 $\pm 0.02^{ab}$	4.295 $\pm 0.02^{abc}$

The growth, nutrient utilization and protein retention was better ($P<0.05$) in Jayanti rohu fry fed diet D-4 containing 35% protein (CP) and 30% carbohydrate (CHO).

From the whole body chemical composition it was found that the moisture, protein and ash contents of the initial fish was significantly higher ($P\leqslant 0.05$) than the final fish for all the diet fed groups, but the whole body lipid and energy contents of the initial fish was significantly lower ($P<0.05$) than the final for all diet fed groups. However, among all the dietary fed groups, the whole body moisture content was lowest and the protein content was highest in fish fed diet D-4.

The study results indicated that the optimum protein and carbohydrate levels for Jayanti rohu fry is 35% and 30%, respectively and therefore, it is concluded that the 5% dietary protein could be spared by increasing 4% carbohydrate level in the diet.

Study the effect of optimum and sub-optimum levels of dietary protein to improve the protein use efficiency in rohu grow out culture

In a 7 months pond experiment, the pre-reared rohu fingerlings (8.0 g) were fed 20 and 25% crude protein and the feeding protocol followed was: Control (C) group: 20% 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; Treatment-3 (T-3): 20% protein for 7 months. Treatment-4 (T-4) : 25% protein for 7 months. The fish were fed 1.5-5% of their body weight in different months. The monthly sampling was done using a drag net and the feed quantity was derived based on the average weight of the fish in each pond. The growth results indicated that the rohu fed diet containing 20% protein for 4 months and 25% protein for rest 3 months had higher growth ($P\leqslant 0.05$) than that of other treatments including control. The final harvesting of the fish 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-conventional oil cake in fish feed as protein supplement is explored. Mohua (*Brasia latifolia*) oilcake for the first time was used in carp feed. Raw oil cake was evaluated for its proximate value. Mohua oilcake (MOC) is protein rich (22-24% crude protein) feed available in plenty at cheaper rate in India. Test feeds (F1 to F5) were developed incorporating Mohua oil cake (MOC) in different inclusion levels at 0,10,20,30, and 40% respectively. Other ingredients were groundnut oil cake, rice bran and vitamin-mineral mixture. Test

feeds were iso-proteous (28% CP). Test animals were *Labeo rohita* fingerlings (5 g each). Indoor rearing period was 90 days. It was found that MOC incorporation at 20 to 40 % showed better weight gain percentages than the test feed containing 0 and 10% incorporation. No significant difference was seen in the survival rate among all the five feeding groups. The FCR was lowest (2.63) where as NPU (65.26) and PER (1.33) were found highest in F4 (40% incorporation) group. All these growth parameters were statistically significant ($P \leqslant 0.05$). The carcass protein (%) was best in F4 group (64.25) followed by F5 (63.32) and F3 (63.13). The biochemical parameters of blood serum showed that total protein, globulin, cholesterol and glucose were at highest level but within the physiological range in F4 group which were statistically significant ($P < 0.05$) among all the five feeding group . Similarly haemoglobin (%) was also statistically high (9.25) in F4 group.

Proximate composition of Mohua Oil Cake (MOC) is pesented in Table 16 and ingredients incorporation levels in test diet are given in Table 17. Proximate composition of test diets is given in Table 18. Survival and some growth parameters like initial weight, weight gain. Carcass proximate composition is given in Table 19. Weight gain (%) and SGR is given in Table 20. It is found that incorporation of mohua oil cake in feed has no adverse effect on their growth and survival. Incorporation level at 40% showed better result.

Table 16. Proximate composition (% dry matter) of Mahua oil cake

Crude Protein (%)	Ether extract (%)	Crude fibre (%)	Ash (%)	NFE (%)
23.8	9.2	6.2	8.4	52.2
Fatty acids				
∑SFA =20.071		∑MUFA 66.197	∑PUFA 7.357	

Table 17. Inclusion (% dry matter) of different ingredients in the test feed for *L. rohita*

Ingredients	Feed I	Feed II	Feed III	Feed IV	Feed V
MOC	0	10	20	30	40
GNOC	49	44	41	37	33
DORB	49	44	37	31	25
Vit& Min	2	2	2	2	2

Table 18. Proximate composition (% dry matter) of the test diets at different inclusion level of MOC

Feeds	Cr.Prot.	Cr. lipid	Ash	Fiber	NFE
Feed I	28.31 ± 0.05	7.45 ± 0.04	6.87 ± 0.44	7.11 ± 0.08	50.26 ± 0.45
Feed II	28.37 ± 0.1	8.16 ± 0.02	6.99 ± 0.02	8.19 ± 0.09	48.29 ± 0.19
Feed III	28.45 ± 0.02	8.43 ± 0.01	6.90 ± 0.01	8.58 ± 0.06	47.64 ± 0.05
Feed IV	28.38 ± 0.06	8.85 ± 0.01	6.70 ± 0.01	8.81 ± 0.01	47.25 ± 0.04
Feed V	28.41 ± 0.04	8.97 ± 0.01	6.56 ± 0.01	8.93 ± 0.03	47.13 ± 0.06

Table 19. Proximate composition of carcass (%) of different feeding group

Treatment	Moisture	C.P	Ether extract	ASH
Feed-1	$77.24^{c} \pm 0.02$	$62.96^{a} \pm 0.02$	$17.36^{b} \pm 0.02$	$16.26^{a} \pm 0.02$
Feed-2	$76.15^{a} \pm 0.03$	$63.27^{c} \pm 0.02$	$18.76^{d} \pm 0.01$	$16.35^{b} \pm 0.02$
Feed-3	$76.17^{a} \pm 0.03$	$63.13^{b} \pm 0.08$	$18.93^{e} \pm 0.02$	$16.47^{c} \pm 0.02$
Feed-4	$76.85^{b} \pm 0.02$	$64.42^{d} \pm 0.01$	$18.06^{c} \pm 0.02$	$17.02^{d} \pm 0.01$
Feed-5	$77.35^{d} \pm 0.01$	$63.32^{c} \pm 0.02$	$16.63^{a} \pm 0.04$	$17.74^{e} \pm 0.02$

Table 20. Growth and survival performance of *Labeo rohita* fingerlings with mohua oil cake incorporated feeds

	Survival %	Weight gain%	SGR	PER	NPU
Feed-1	97.2	90.47	0.53 ± 0.04^{b}	$1.17^{a} \pm 0.00$	$33.68^{a} \pm 0.60$
Feed-2	100	93.71	0.22 ± 0.04^{a}	$1.12^{a} \pm 0.02$	$36.94^{ab} \pm 0.57$
Feed-3	100	100.57	0.17 ± 0.03^{a}	$1.18^{ab} \pm 0.03$	$37.65^{b} \pm 1.04$
Feed-4	97.2	108.38	0.17 ± 0.07^{a}	$1.33^{c} \pm 0.05$	$65.26^{c} \pm 1.83$
Feed-5	97.2	103.05	0.48 ± 0.05^{b}	$1.27^{bc} \pm 0.04$	$39.86^{b} \pm 0.70$

Utilization of jute leaf as alternate fish feed ingredient

In Jute leaf dry matter ranges from 30.90 to 32.95%, protein ranges from 14.52 to 15.18 (%), fat 2.31 to 2.16% and ash 8.46 to 10.50 (%), respectively. The Jute leaf was used as one of the ingredient in powdered form in rohu feed, where 10, 20, 30 and 40 (%) level of jute leaf was incorporated along with other ingredients in basal diet. The growth trial was conducted for 60 days with *Labeo rohita* fingerlings (av. wt. 16.37g) to evaluated different levels of jute leaf incorporation in rohu feed under laboratory condition. The net weight gain was higher in rohu fingerlings fed with 20% of jute leaf. Thus jute leaf could be incorporated in rohu feed up to 20% level as an alternate fish feed ingredient.

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

Three types of iso-nitrogenous floating feeds were formulated for Indian Major Carps (IMC) and prepared in extruder by using different feed ingredients. The 1st feed (SMF) was formulated with soyabean meal as main protein source whereas 2nd (GNF) and 3rd (TCF) feed were formulated by replacing a part of soyabean meal with alternative feed ingredients i.e. groundnut cake and til oil cake respectively. The floating percentage, sinking percentage and apparent density (g/cm^3) were not affected on three different types of floating feeds. The crude fibre (CF) and ether extract (EE) percentage of the TCF was highest among three floating feeds whereas as nitrogen free extract (NFE) was highest in SMF feed. The proportion of omega 3 fatty acids of three types of feeds did not differ significantly ($P<0.05$), but omega 6 fatty acids of SMF were higher than GNF and TCF feed. The growth performance of TCF was comparable to GNF floating feed whereas it was superior to SMF floating feed. The feed cost was lowest in TCF and highest in SMF feed. This indicated that, the floating feeds (GNF and TCF) developed by replacement of soyabean meal with ground nut oil cake and til oil cake are superior to floating feed (SMF) prepared by inclusion of only soyabean meal and this might be economic for the farmers. In the 2nd phase of experiment, til oil cake based floating feed was 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, ether extract, crude fibre, nitrogen free extract and gross energy 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. The digestibility experiment showed that the DM and CP digestibility were not affected on different sets of extrusion temperatures whereas the intake of feed was highest in IMC prepared at extrusion temperatures of 130 or 150 ^{0}C. This indicated that best quality floating feed could be prepared from ingredients by maintaining temperature of 130-150 ^{0}C and moisture level of 20 - 22% including the moisture in the feed.

A til oil cake based floating feed prepared during the experiment

Sub-project	:	Neuroendocrine regulation of gonadal maturation through environmental manipulation during out of breeding season in catla
Project Code	:	I-89
Funding Agency	:	Institute-based
Duration	:	April 2014 – March 2017
Project Personnel	:	Ashis Saha (PI), S. C. Rath and P. C. Das

Gonadal maturation of catla through manipulation of environmental cues during seasonal resting phase

Catal brood were raised and reared in the indoor rearing condition from September 2014 to January 2015. The fishes were exposed in three different photothermal regime: long photoperiod (photoperiod hours is more than that of natural photoperiod) in combination with water temperature above than ambient temperature (T1), long photoperiod with water temperature same that of ambient temperature (T2) and natural photothermal as prevailed in pond as control. Experimental tank of T1 group was provided with thermostat controlled heaters to maintain water temperature consistently above the ambient temperature. During month of December 2014 few male and female showed secondary sexual characteristics as sign of gonadal maturation in T1 group where as no such characteristics were observed in T2 and control group. Males were found free oozing with milt volume, spermatocrit value and sperm motility in the range of 6-8 ml kg^{-1}, 85-92% and score of 4+ in a 5 point scale respectively in the month of January 2015. Two set of brood (1:1 male and female/set) were induced bred on 28.1.2015 and about 2.5 lakhs fertilized eggs (92%) were produced. Thus, the present research indicated the possibilities of catla breeding during seasonal resting phase (October-December) by photothermal manipulation.

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)

Cloning and characterization of full-length cDNA of follicle stimulating hormone receptor (FSHR) and its expression during photothermal induced gonadal development in rohu

Full length cDNA sequence of rohu FSHR was obtained by RACE strategy. The deduced, full length rohu FSHR (GenBank Accession No: JX678220) cDNA was 3633 bp in size with a 231 bp 5'UTR, 1119 bp 3'UTR and 2013 bp ORF encoding 670 amino acid (aa) corresponding to 87.6 KD translated protein. The receptor has a typical structure of a G-protein-coupled receptor (GPCR). The domain prediction by SMART revealed a signal peptide of 22 aa located in the extracellular domain (ECD) followed by seven trans-membrane domain (TMD1-7) and finally the C terminal end formed an intracellular domain (Fig. 25). The rFSHR protein contained five N- linked glycosylation sites as predicted by NetNGlyc 1.0 server. The rFSHR protein possesses 13 conserved cysteine residues, five of them in the N-terminal region and eight in the TMD region. The rFSHR amino terminal region consists of nine imperfect leucine-rich repeats (LRRs). The intracellular C-terminal domain of the rFSHR consisted of thirteen serine, six tyrosine and six threonine residues which are active site for phosphorylation. To know the phylogenetic relationship of FSHR protein, the deduced aa sequence of rohu was analyzed with its full length homologs in other species as shown in Fig. 26. Bootstrap analysis and consensus trees obtained from Neighbor Joining analysis showed that rFSHR exhibits highest homology with zebrafish which cluster in the same branch with a high bootstrap value. Expression pattern of rFSHR mRNA were done by quantitative real time PCR and the present result indicated differential expression of FSHR transcript in male and female during photothermal induced gondal development.

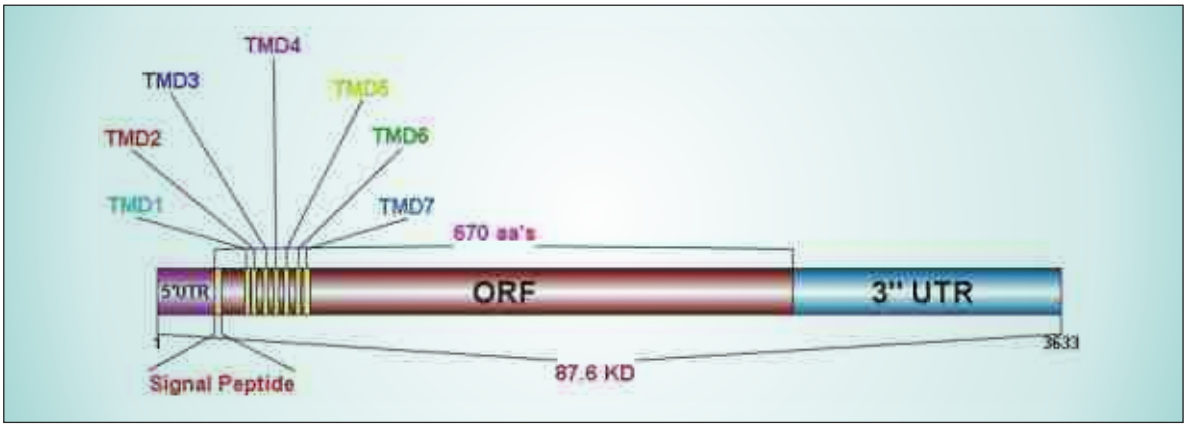


Fig. 26. Schematic representation of the structure of rohu FSHR

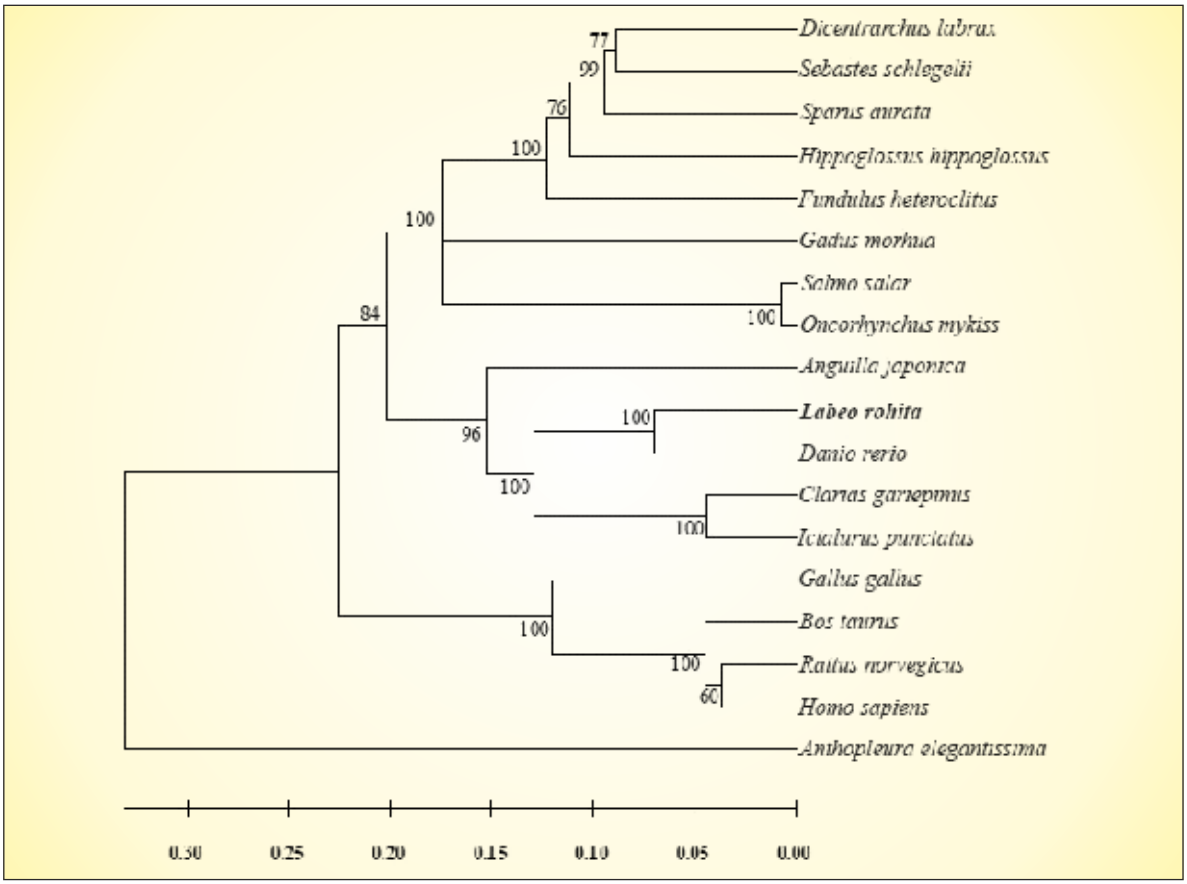


Fig. 27. Phylogenetic relationship of deduced amino acid sequence of rohu FSHR gene with vertebrate species

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

Cloning, characterization and expression of rohu Kiss1 cDNA

Recently, the importance of kisspeptin system to control the reproduction has been established in many vertebrate species excluding avian species that lack kisspeptin. Kisspeptin are peptide products of KISS1 gene and belongs to the RFamide family. To determine the involvement of kisspeptins in the gonadal development of rohu characterization and basal expression in various tissues were carried out. To amplify Kiss1gene, PCR primers were designed based on sequences

of other fish species available in the public domain. The amplified fragments were cloned and sequenced. Based on these partial sequence, the RACE primers were designed to obtain rest of the 5' and 3' ends. Rohu Kiss1(rKiss1) cDNA (GenBank KF737179) was 660 bp, with a 5′ untranslated region (UTR) of 39bp, 3′ UTR of 270bp and an open reading frame (ORF) of 351bp encoding a precursor protein of 116 amino acids (aa) with a predicted signal peptide of 19 aa. A putative polyadenylation signal (AATAAA) was noted 26 bp upstream of the poly-A tail. Alignment analysis based on the amino acid sequences of rohu Kiss1 with other vertebrates species showed higher similarity with *Gobiocypris rarus* (80%), followed by *Danio rerio* (77%) and *Carassius auratus* (72%). With other fish species it showed very low similarity (<40%). To know the phylogenetic relationship of Kiss1, the deduced aa sequence of rohu was analyzed with its full length homologs in other species as shown in Fig. 27. The result of qRT-PCR analysis revealed that Kiss1 transcript is not only expressed in reproductive tissues but also it expressed in non-reproductive tissues of both male and female rohu.

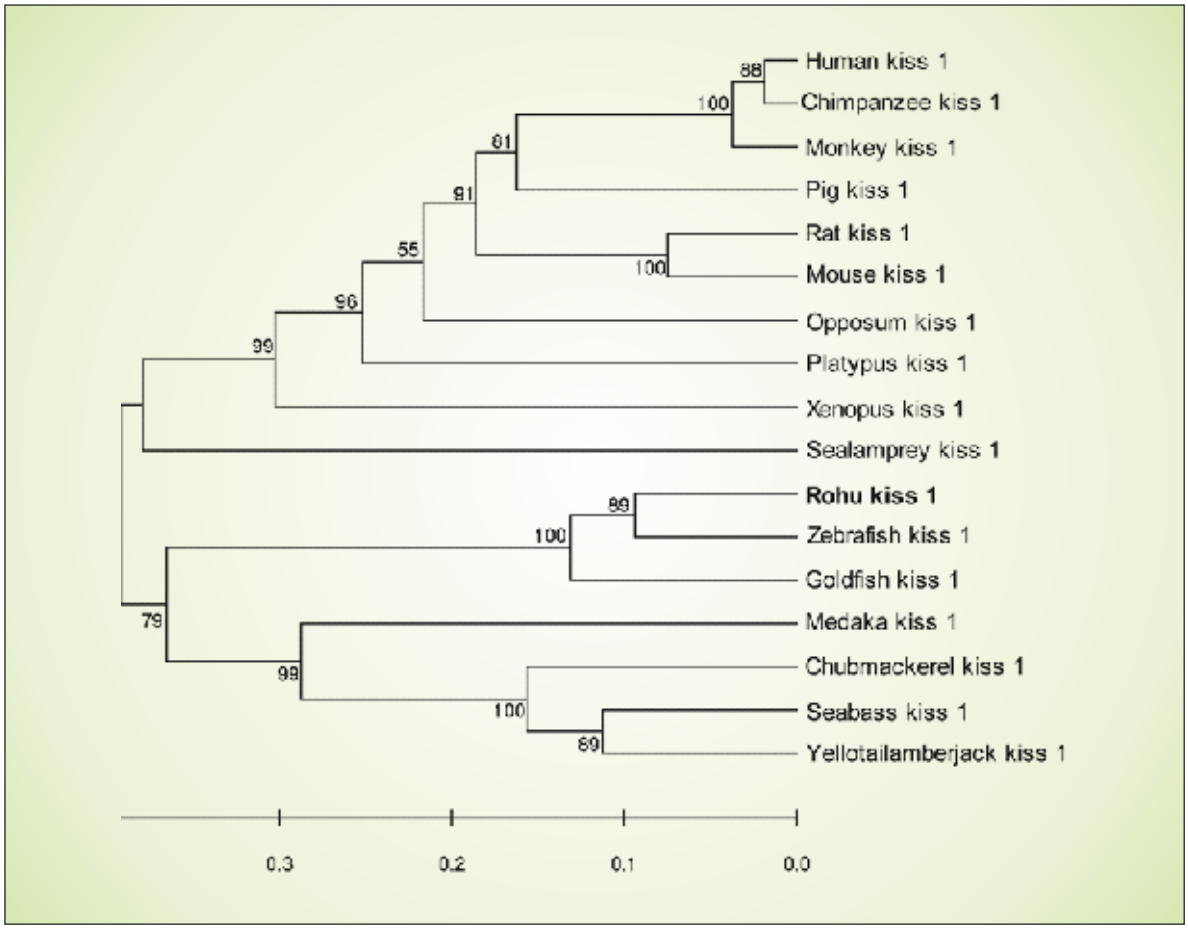


Fig. 28. Phylogenetic relationship of deduced amino acid sequences of rohu kisspeptin genes with vertebrate species. The consensus tree was inferred using the Neighbour-Joining algorithm and the branch points were validated by 1000 bootstrap replications.

OUTREACH PROJECT

Project Title	:	Outreach activity on Fish feed
Funding Agency	:	ICAR
Duration	:	April 2012- March 2017
Project Personnel	:	S. S. Giri (PI), S. C. Rath, S. K. Sahoo, P. V. Rangacharyulu, N. Sridhar, B. N. Paul, K. N. Mohanta, and K. C. Das

Hands –on training on farm feed preparation and floating feed management in West Bengal:

A Training-cum-Demonstration Programme on "Farm Made Feeds in Aquaculture" under Outreach Activity on Fish Feeds (A Network Project of Indian Council of Agricultural Research, New Delhi) was organised at Barjora, Bankura on 7th August 2014. At Vivekanada Atmabikash Kendra, the programme was inaugurated by Swamiji Rangalal Maharaj. Among others Dr. S.S. Giri, Coordinator of Fish Feeds Outreach prgraomme, Dr. B.N. Paul, Principal Scientist,Dr. S.C. Rath, Nodal officer and Senior Scientist, Dr. R.N. Mandal, Senior Scientist, Dr. A. K. Dutta and Dr. P.K. Mukhopadhyay, former Principal Scientists, CIFA, Mr. Abhijit Banerjee, ADF, Bankura and Mr. Amit Gayen, Joint B.D.O. joined as resource persons. The programme was aimed to create awareness and disseminate technology to the local fish farmers on preparation and use of farm made fish feed for their own fish crop. An exhibition on different commercial feed types, conventional and non-conventional feed ingredients was organised. Preparation of pelleted farm feed was also demonstrated to the fish farmers. The programme was followed by a farmers-scientist interface meeting in which farmers clarified their doubts on the subject. Over 200 participants joined in the programme. The event was coordinated by Dr. B.N. Paul, S.C. Rath and R.N. Mandal.

Training on farm made feed for fingerling raising at Keonjhar, Odisha

The critical input for carp culture is advance fingerlings. Therefore fingerling raising programme in farmers pond is being insisted before stocking the pond for growout culture. Feed is the foremost basic requirement to grow heathy fingerling in good number in a rearing pond. Therefore, a two days training cum demonstration programme was conducted at Champua and Sadar Block of Keonjhar district, Odisha in collaboration with District Fishery Office and Agriculture Technology Management Agency (ATMA). A total 49 progressive farmers were trained.

One training cum demonstration programme on farm made feed for fingerling culture was arranged at Remuli Revenue Office of Champua for Fish farmers on 10.1.2015. There were 25 farmer participants. Apart from farmers, 2 AFOs and Additional District Fisheries Officer also joined in the training. The programme was started with class room awareness programme about fish feed and availability of different feed ingredients in that locality. The awareness programme was followed by live demonstration of different feed ingredients; feed types and farm feed dispensing models. The programme came to an end with farmers interaction for about two hours.

On second day (11.1.2015) the training cum demonstration programme was conducted at the District Agriculture Office, Keonjhar for fish farmers of Sadar block. There were 24 fish farmers

participants, one Asst. Agriculture Officer and one Asst. Fisheries Officer in the training programme. The District Fishery Officer, Additional District Fishery Officer and Dy Project Director (ATMA) were also present as co-organiser. There were three sessions. In session-I, class room training was imparted with the help of E-learning module on 'Carp Feed' followed by the demonstration session of feed and feed dispensing models in Session II. Session III was devoted for farmers interaction in the subject.

Floating feed demonstration in farmers pond

Floating feed demonstration was done in the farmer's pond at Betnoti, Mayurbhanj on 25th September, 2014. Benefit of feeding floating feed was explained to the farmers. An exhibition on fish feed was organized and a farmers meet was also arranged to create awareness regarding fish feeds and feeding of fish. About 100 farmers participated in the programme. Few quintal of fish feed, prepared in the Institute feed mill was distributed to the farmer for demonstration. The programme was co-ordinated by Dr. K.N.Mohanta and Dr. K. C. Das. Dr. P. Jayasankar, Director, ICAR-CIFA inaugurated the programme.

Project Title	:	Outreach activity on Nutrient profiling of fish
Funding Agency	:	ICAR
Duration	:	April 2013 – March 2017
Project Personnel	:	B. N. Paul (PI), S. S. Giri and N. Sridhar

Fish samples of bata, pabda, punti, channa, mystus, wallago, pangas, calbasu, reba and fimbriatus were collected from Champadali and Court bazar fish market, Barasat & Rahara Fish market; Howrah fish market; Malancha fish market; Kharibari fish market, North 24 Parganas; RRC Rahara fish farm and RRC Bangalore. The fish samples were processed as per the common methodology of Outreach Activity on Nutrient Profiling Project for further analysis & presented below (Table 21-24)

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

Particulars	Moisture	Protein	Fat	Ash
L. fimbriatus	73.28-78.78	16.29-16.95	1.65-1.98	2.61-2.92
C. reba	71.33-77.40	13.00-15.55	2.10-3.65	1.65-2.35
L. calbasu	71.6-80.24	14.84-19.87	2.60-4.95	1.53-2.98
L.bata	72.02-77.27	15.22-20.58	3.61-5.88	1.72-3.93
P.javanicus	72.05-79.48	12.05-17.24	1.87-5.48	1.64-2.69
P.sutchi	66.83-78.26	10.71-14.78	5.93-9.25	1.42-3.05
W.attu	69.25-77.92	13.04-14.79	1.94-7.72	1.06-2.04
M. vittatus	68.97-72.31	15.52-16.09	3.23-5.88	2.35-2.77
C. striata	71.28-79.07	13.12-17.87	1.03-4.88	2.13-3.71
O. bimaculatus	71.93-79.51	11.77-16.56	1.82-4.41	1.92-3.25

The moisture content of fish ranges from 66.83 to 80.24 (%), protein from 10.71 to 20.58 (%), fat ranges from 1.03 to 9.25 (%) and ash from 1.06 to 3.93 (%).

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

Species	Particulars				
	SFA	MUFA	PUFA	EPA	DHA
W. attu	57.94	33.74	8.33	0.29	0.16
C.reba	71.01	4.31	24.63	3.81	8.04
L.calbasu	52.02	36.14	11.84	1.87	0.23
P.sutchi	23.77	55.01	21.31	-	1.47
P.javanicus	28.45	47.83	23.55	3.88	0.44
L.fimbriatus	91.41	4.46	4.02	0.16	0.46
M.Vittatus	76.60	6.95	16.25	1.84	2.09

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
L. fimbriatus	0.43-0.55	0.58-0.70	0.09-0.13	0.16-0.21
C. reba	0.35-0.43	0.48-0.56	0.15-0.27	0.19-0.35
L. calbasu	0.34-0.68	0.56-0.90	0.17-0.21	0.17-0.21
L.bata	0.25-0.54	0.36-0.47	0.29-1.91	0.2-0.24
P.javanicus	0.28-0.35	0.54-0.81	0.13-0.87	0.15-0.24
P.sutchi	0.43-0.58	0.46-0.56	0.25-0.85	0.25-0.41
W.attu	0.26-0.28	1.15-1.82	0.33-0.47	0.29-0.31
M. vittatus	0.24-0.25	0.16-0.30	021-0.25	0.21-0.28
C. striata	0.26-0.28	0.36-0.46	0.20-0.22	0.16-0.22
O. bimaculatus	0.29-0.34	0.58-0.59	0.23-0.24	0.23-0.43

Table 24. Mineral content (ppm) of different fish species

Particulars	Sodium	Potassium
C. reba	36.60-39.91	111.46-123.40
L.bata	40.50-55.50	150.53-222.0
P.sutchi	45.8-50.95	133.17-153.17
W.attu	19.78-45.34	105.41-144.41
C. striata	22.52-38.82	144.86-210.38
O. bimaculatus	55.24-56.97	133.16-144.31

The Iron content (ppm) in different fish species varied from 0.24-0.68, zinc from 0.36- 1.82, copper from 0.09-1.91 and manganese from 0.15-0.43. The macro minerals viz., sodium content (ppm) ranges from 19.78- 56.97 and potassium from 105.41-222.0.

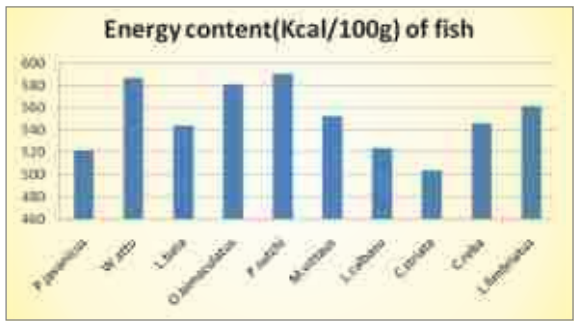


Fig. 29. Gross Energy content of different fish species

The gross energy content in the fish species ranges from 504-587 Kcal/100g

D. Fish Health Management

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, 2015
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

Technology Commercialized

CIFAX was commercialized for third time for Rs. 2,27,77,777/- for a period 7 years to M/s. Agrawal Trading Co., 1st Floor, Maa Annapurna Complex, Banjari road, Raipur-492001, Chhattisgarh with effect from 10 November, 2014.

Project Title	:	The nature of impact of abiotic stresses on three diverse freshwater species of fishes
Project Code	:	E-70
Funding Agency	:	NFBSFARA-ICAR
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)

Following abiotic stressor like low and high dissolved oxygen concentrations, the expression of TLR1 gene was analysed in *Channa punctatus*. The result of quantitative real-time PCR revealed down-regulation of TLR1 gene expression in all tested tissues (gill, liver, kidney and blood). However, in hyperoxic stresses, TLR1 gene expression was significantly enhanced in kidney suggesting the important role of TLR1 in hyperoxic stress (Fig. 29).

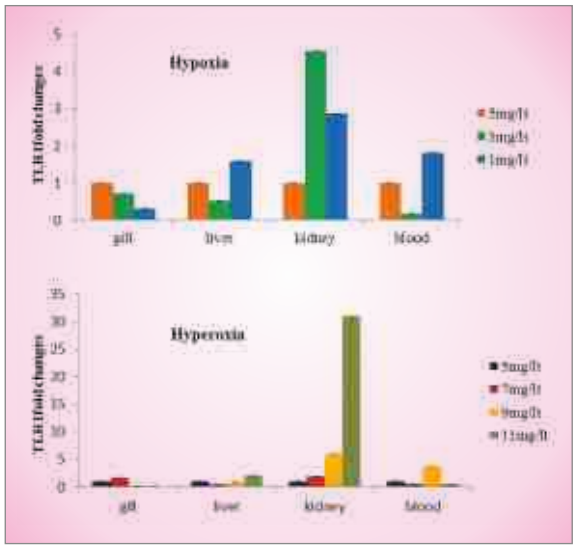


Fig. 30.

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)

Transcriptional changes in immunoglobulin molecules of Labeo rohita in response to *Argulus siamensis* infection

The modulation in the transcriptional expression of genes encoding three immunoglobulins, namely immunoglobulin M (IgM), immunoglobulin Z (IgZ) and immunoglobulin D (IgD) in response to *A.*

siamensis infection over a period of 30 days post-infection was studied. Gene expression profiling was carried out in skin, mucus and head kidney tissues using real-time RT-qPCR analyses.

The infection with *A. siamensis* increased the expression of IgM transcripts at almost all the time points studied in the kidney tissue of infected L. rohita (Fig. 4). IgM expression was not in detectable range in skin and mucous tissue samples collected from infected rohu samples at different time points. Rapid up-regulation of IgM in head kidney suggests the recruitment of B cells in response to the parasite infection. In head kidney, the expression of IgZ peaked at early time point of 12 h as compared to control (3.08-fold) which subsequently decreased to control levels at 24 h and 3 d p.i. At later time points of 7 d and 30 d p.i., the expression showed significant increase of 1.37 and 1.85 folds, respectively compared to control. In skin, the expression reached its peak at 3 d p.i. (2.77-fold) and statistically significant ($p < 0.05$) increase also occurred at 24 h p.i. (1.3-fold). In mucous, the expression peaked at 30 d p.i. (3.43-fold). The results of IgZ expression analysis are illustrated in Fig. 31 which indicate the potential role of IgZ in mounting an adaptive immune response (both systemic and local mucosal) in response to parasitic invasions.

For IgD, variable expression pattern was detected in different tissues used in the study. In head kidney, the expression peaked in comparison to control at 30 d p.i. (11.89-fold). Also, the expression was detected to be statistically higher ($P < 0.05$) at all time points after 12 h onwards. In skin, the expression of IgD peaked at 3 d p.i. in infected tissue (3.04-fold). The expression of IgD peaked at 24 h p.i. (8.39-fold) in mucous. Here, the rapid up-regulation in IgD transcripts in both mucous and skin indicates that IgD might have a role in mucosal immunity in addition to enhancement of systemic Ig response along with IgM.

This study showed that parasitic invasion can be triggering factors for varied immunoglobulin type expression to provide systemic as well as local protection in the host (Fig. 32).

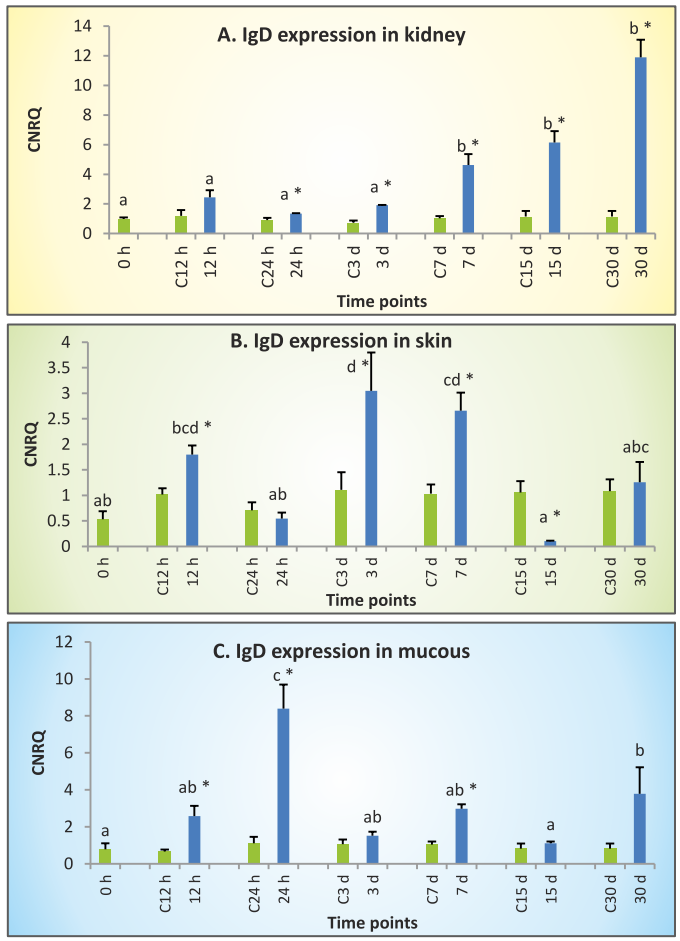


Fig. 31. Real time quantitative gene expression profile of IgD in the head kidney (A), skin (B) and mucous (C) of *L. rohita* at different time points (0, 12, 24 h, 3, 7, 15 and 30 d) following infection with A. siamensis(blue bars). Control samples (green bars) have been included at each time point. Bars represent the mean ± SEM (n = 3) calibrated normalized relative quantities (CNRQs). Statistical analysis was made by one way ANOVA among expression levels of infected samples of the different time points and significant differences are represented by alphabets (a, b, c, d). Statistical analysis between expression levels of control and infected sample at each time point was done by Students't-test and significant statistical difference is represented by *.

Variation in susceptibility pattern of fish to *Argulus siamensis* and the role of immune response in susceptibility

From field observations, rohu (*Labeo rohita*) and catla (*Catla catla*) appeared to be the most susceptible species whereas silver carp (*Hypophthalmichthys molitrix*) was a resistant species in polyculture system. Mrigal (*Cirrhinus mrigala*) and other medium carps are also found to be affected considerably. However, to date there is no published report or systematic study to evaluate the comparative susceptibility or resistance of various carp species to Argulus infestation.

Comparative susceptibility of eight host species to *A. siamensis* infection

Juveniles of eight species of fish (*Labeo rohita*, *Cirrhinus mrigala, Catla catla, Hypophthalmichthys molitrix, Cyprinus carpio, Ctenopharyngodon idella, Carassius auratus* and *Labeo fimbriatus*) were used in this experiment. Based on the observed parasite load on each species, the species were graded on scale of susceptibility to *A. siamensis* infection and *L. rohita* was found to be the most susceptible species harboring maximum quantum of parasites in all samplings followed by fimbriatus and catla. Grass carp and silver carp were the least affected species and appeared to be resistant to Argulus infestation. The susceptibility pattern is illustrated in Fig. 33. Based on the observations in experimental polyculture condition, *L. rohita* is proved to be the most susceptible among the IMC's.

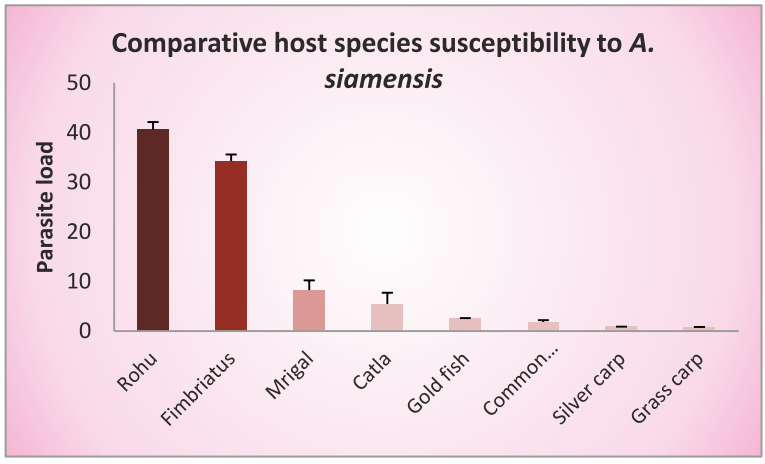


Fig. 32. Parasite burden (mean of lice/fish) on the eight fish species observed in a 45 days experiment.

Comparative survival and settlement of A. siamensis on susceptible and resistant hosts

L. rohita had more parasites than *C. idella* at all four time points (24 h to 96 h) suggesting reduced settlement and survival of *A. siamensis* on the resistant host. The mean counts decreased over time for both the species.The parasite settlement data (Fig. 32) showed that at 24 h post-infection most parasites had settled on the fins followed by head regions rather than on the body in rohu with a similar trend in grass carp as well. In rohu, the highest parasite load was evident on the fins at 48 h and 72 h. However, over the time (48 h to72 h) the number of parasites gradually increased on body surfaces and head. In case of grass carp, by 72 h post-infection, the highest parasite load was shifted from fins to body surface also. As the infection progressed (at 96 h post-infection), the highest parasite load was found on the body surfaces in both the species.

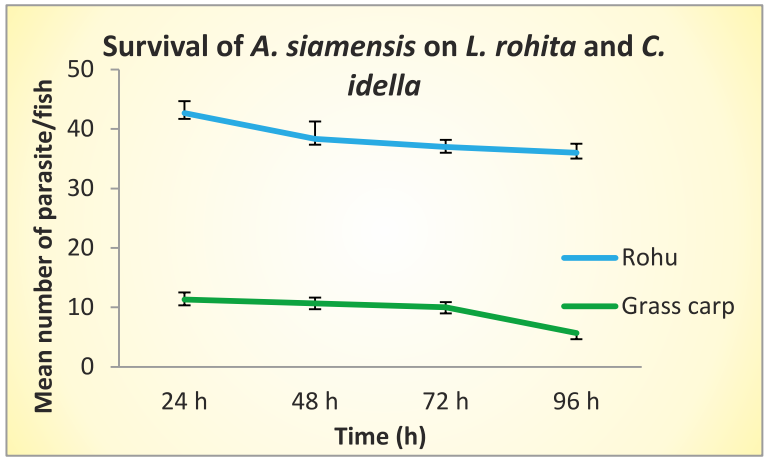


Fig. 33. Mean number of parasite/fish observed 24 h, 48 h, 72 h and 96 h post *A. siamensis* infection in rohu and grass carp

Comparative normal range of innate immune parameters in susceptible and resistant hosts

The packed cell volume (%) and myeloperoxidase activity of grass carp was found to be significantly higher than ($p<0.05$) rohu. There was no significant ($p<0.05$) difference in the serum antiprotease level and respiratory burst activity between both the species. The serum complement, ceruloplasmin and lysozyme activities of serum of grass carp was significantly lower ($p<0.05$) compared to that of rohu (Table 25).

Table 25. Immunological parameters of naïve rohu and grass carp. Data are presented as mean ± S.E. Means bearing *superscript(s) are significantly different ($P < 0.05$) within a row.

Innate Immune Parameter	Rohu	Grass carp
PCV (%)	15.70±1.3	21.95 ± 1.26*
Total serum antiprotease (% inhibition)	26.38±2.76	21.99±2.92
Ceruloplasmin activity (units 25 μl^{-1})	0.34± 0.03	0.17± 0.05*
ACH_{50} (units/ ml)	36.36±4.96	16.85±1.70*
Lysozyme activity ($\mu g\ ml^{-1}$)	23.29±2.48	11.34±1.82*
Myeloperoxidase activity (OD at 450 nm)	0.18± 0.02	0.51± 0.06*
NBT assay (OD at 540 nm)	0.23 ± 0.03	0.24 ± 0.05

Comparative immune responses in skin of susceptible and resistant hosts following A. siamensis infection

L. rohita and *C. idella* juveniles were divided into three groups viz., *A. siamensis* infected, mechanically abraded and non-infected/abraded control. Skin samples were collected from sites of parasite attachment and non-attachment on the same fish, from four individuals at 24 h and 3 d post-infection, respectively.

For each species, at each time point, the expression ($p<0.05$) levels of few immune relevant genes in skin at the sites of attachment and non-attachment, mechanical abrasion and naïve fish skin were measured and compared. In rohu the expression level of TLR 22 in all three treatment groups was significantly lower ($p<0.05$) than that of control at both the time points. A similar trend was observed in case of IL1β expression. Although not significant, the expression of MMP 2 and MHC IIb was found to increase at sites of parasite attachment and mechanical abrasion at 24 h and 3 d post-treatment.

The expression levels of TLR 22 were significantly lower ($p<0.05$) in the treatment groups as

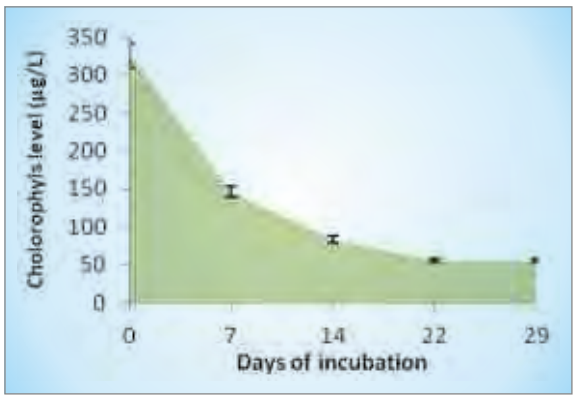
compared to control in case of grass carp as well. There was general increase in the expression of IL1β, which was significant only in the mechanically abraded samples at 24 h post-treatment. MMP 2 and MHC IIb showed significant ($p < 0.05$) increase in expression at both the time points compared to control. The expression of MH class II and MMP 2 was significantly higher ($p < 0.05$) in grass carp compared to rohu and therefore appeared to be involved in the early protective response 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)

Metal nanoparticles for control of freshwater algae and algal blooms

Algal growth is a major concern in the freshwater aquaculture pond and aquarium and causes a variety of stresses and loss to cultured fishes. Metal nanoparticles such as zinc oxide, copper oxide, selenium and iron were used to study their algicidal and antialgal properties. Algal strains for this study were isolated from the aquaculture ponds and fisheries gadgets of CIFA and different temple ponds situated in Bhubaneswar, Odisha (Figs. 33&34).

Fig. 33. Different algal sources in aquaculture pond (A), Cement tanks (B), Nursery tubs and (C) different fisheries gadgets.



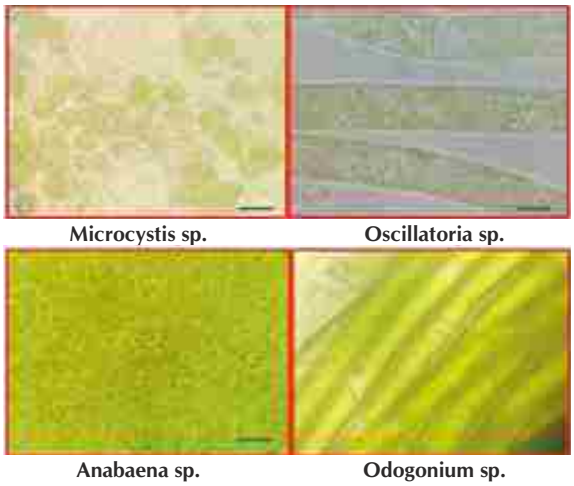


Fig. 34. Algal strains found in freshwater aquaculture systems.

Results showed that, selenium, zinc oxide and copper oxide nanoparticles were algicidal and inhibited algal growth via pore formation and disruption of plasma membrane (Fig. 35), efflux of intracellular components and reduced the chlorophyll contents of different harmful and harmless algal species such as *Microcystis*, *Anabaena*, *Oscillatoria* and *Odogonium* (Figs. 36A&B). Thus, the ability to control and eliminating algal blooms in ponds and aquarium might benefit the aquaculture in several ways.

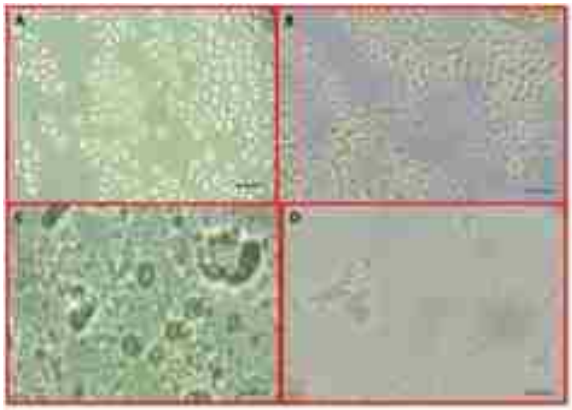


Fig. 35. Morphological changes of *Anabaena* sp. in the presence of zinc oxide nanoparticles (A) cells incubated without (1) or with zinc oxide nanoparticles B: 0.01 mg, C: 0.1mg/ml, D: 1mg/ml after 2 hr of incubation. Bar: 100 μm for all panels.

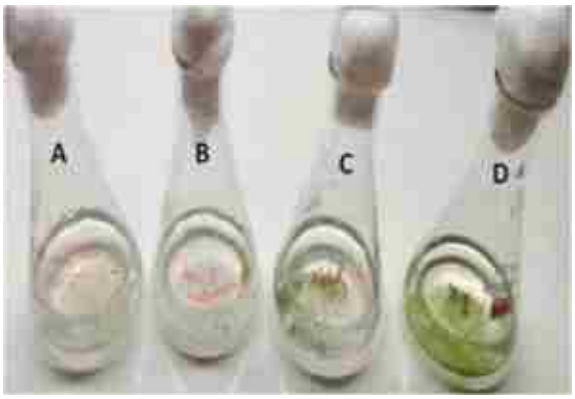


Fig. 36. (A)Chlorophylls levels of Anabaena sp. in the presence of zinc oxide nanoparticles (0.1mg/ml) at different incubation period (B) Algal growth and cellular pigmentation after 7 days of incubation. To each flasks containing Anabaena sp. with exception of blank sample (D) were added zinc oxide nanoparticles at different conc. A 0.01mg/ml (C), 0.1 mg/ml (B), 1 mg/ml.

Metal nanoparticles for color development in koi carps

Dietary iron and zinc nanoparticles were used to find out their impact on color development and pigmentation. They had a negative impact on body coloration and carotenoid content of skin in koi carps. We also found that, all the treated groups having different concentration of iron and zinc nanoparticles significantly decreases ($p < 0.05$) the carotenoid content of muscles. The color intensity of all the treated groups was decreased irrespective of different doses. However, the intactness and shining of skin was remarkable as compared to control (Fig. 37).

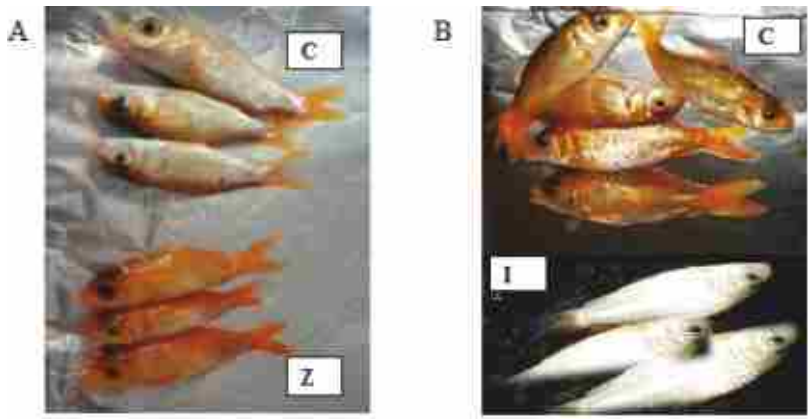


Fig. 37. Body coloration of koi carps in different treated groups A; (C- control group, Z - Zinc nanoparticles), B; (C- control group, I - Iron nanoparticles).

Metal nanoparticles as antifungal and antibacterial feed additives

Zinc oxide (ZnO) nanoparticles were used to study its antifungal activities and their effects on reducing the microbial load in comparison with some commercial antifungal feed additives. Results showed that, these nanoparticles inhibited the growth of *A. flavus* strains that were isolated from feeds, using well and disc diffusion tests. Zone diameter of growth inhibition increased when the concentration increased. The zones of inhibition produced by the metal nanoparticles were larger than that produced by the commercial antifungal feed additives. In addition to that, feed supplemented with higher dose of zinc nanoparticles (10 mg/g^{-1}mg/g) were found to inhibit *Pseudomonas* sp., *Enterobacter* sp. and *Erwinia* sps. The field application of the above used nanoparticles for commercial fish feed were under progress (Fig. 38).

Fig. 38. ZnO nanoparticles supplemented fish feed

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) and S. S. Mishra

All the three Indian major carps viz, rohu (*Labeo rohita*), mrigal (*Cirrhinus mrigala*) and 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 1000l 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, day 2, day 3, day 4, day 5, day 7 and day 14 were studied in experimental and control group of fishes. 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. 39 & 40). The expression of Mx was found maximum in fourth day in catla liver (Fig. 41).

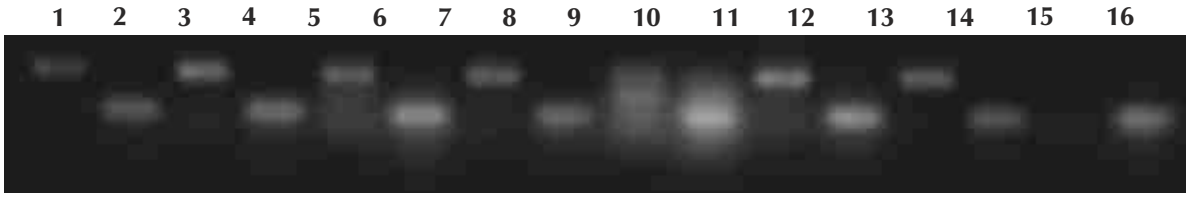


Fig. 39. Mx expression and β actin expression in different tissues of control fish rohu

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.

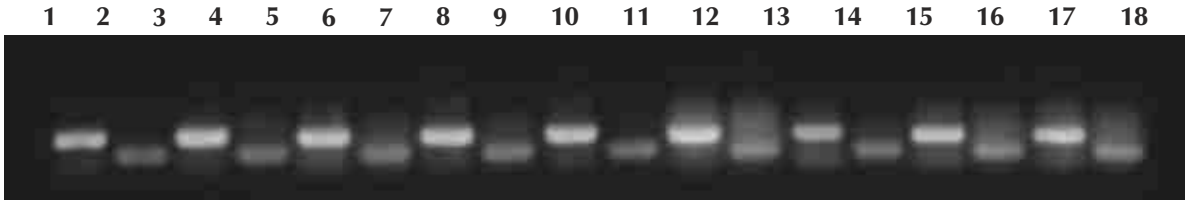


Fig. 40. Mx expression and β actin expression in different tissues of treated fish rohu injected intramuscularly with 1mg of Poly I:C (1st Day)

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.

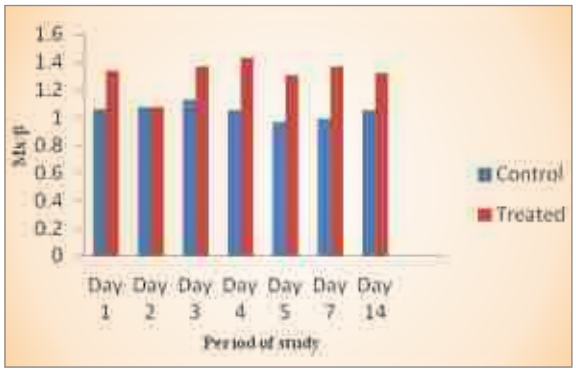


Fig. 41. Expression kinetics of Mx gene in liver of catla as compared to β actin

Ontogeny of Mx expression was studied in mrigal

The present study was done to understand the expression kinetics of Mx in different stages of mrigal. For the first time, the presence of Mx transcript in mrigal egg and fertilized egg after treatment with polyI:C has been reported. An explicit presence of Mx transcript in mrigal fry compared to hatchling was also observed (Fig. 42). Similar observations were also seen in the developmental stages of *Labeo rohita* and *Catla catla*. Thus, the difference in the immune response to polyI:C, induction of Mx transcript amongst the different developmental stages was studied extensively.

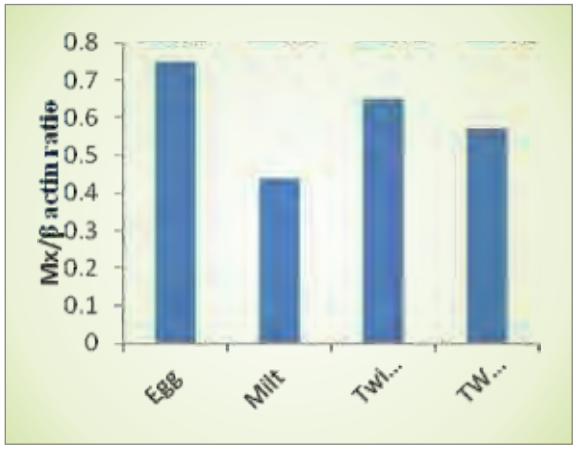


Fig.42. Mx/β actin ratio in egg, milt, twitching treated and twitching control of mrigal

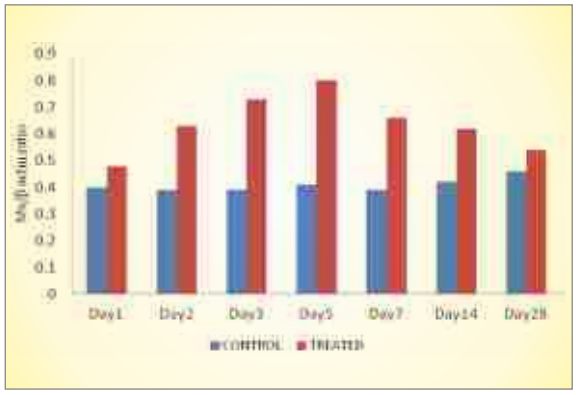


Fig.43. Mx/β actin ration in fry of mrigal treated and control for an experimental period of 28 days

Fry were injected with 1mg/ml (polyI:C) and studied for an experimental period of 28 days. On 5th day, the maximum Mx expression was seen in fry and then a gradual decrease in Mx expression was seen up to 28 days (Fig. 43).

Immunomodulatory nature of Mx transcript

The purpose of this study was to investigate the expression kinetics of Mx transcript to OmpC, *A. hydrophila* and *Trichodina* spp in different tissues of mrigal. Thus, it has been sighted for the first time that Mx expression in mrigal is stimulated by both OmpC of *A. hydrophila* as well as *A. hydrophila* itself, but expression is more in case of OmpC (Fig. 44).

Fig.44. Effect of OmpC on Mx expression in kidney of mrigal

The partial sequence of Mx of Rohu (KM216417), Mrigal (KP033198) and Catla have been submitted in the Genbank (KP282448).

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

Several virulent associated genes were identified and primers were designed. Various primers combination was tested in PCR for the detection of virulent *Aeromonas hydrophila*. The data revealed that most of the virulent associated genes are shared among *A. hydrophila, E. tarda, S. uberis* and *B. subtilis*. However, some portion of OMP (outer membrane protein) gene is specific to virulent *A. hydrophila* and can be the target for the detection of *A. hydrophila* infection in fish through PCR (Fig. 45).

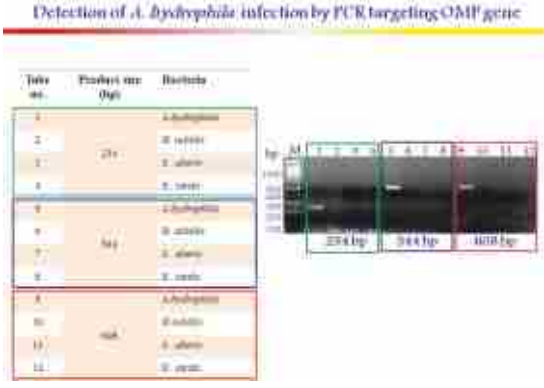


Fig. 45. Detection of A. hydrophila by PCR targeting OMP gene

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)

In rohu, hyper immune serum has been raised against BSA and *Aeromonas hydrophila* antigens. Immunoglobulins have been purified through affinity chromatography. Immunoglobulin M (IgM)- heavy chain (H) gene and full length cDNA have been cloned by Genome walking and RACE respectively (Figs. 46&47). IFN-gamma rel gene of rohu has been cloned and expressed as recombinant protein (Fig. 48).

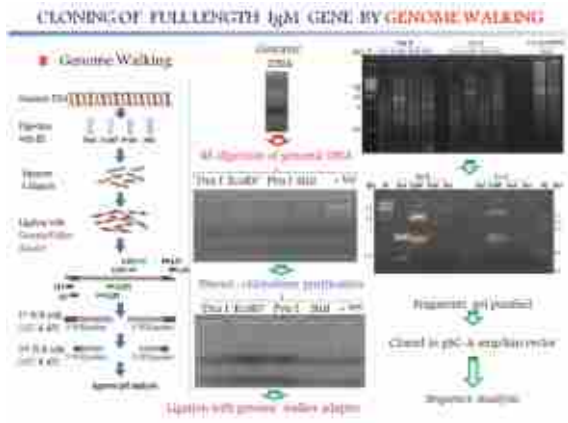


Fig. 46.

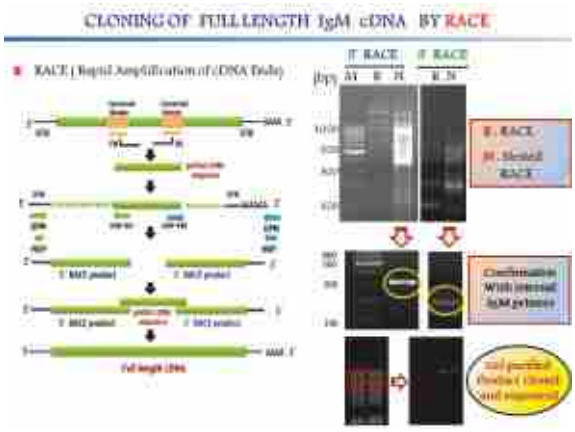


Fig. 47.

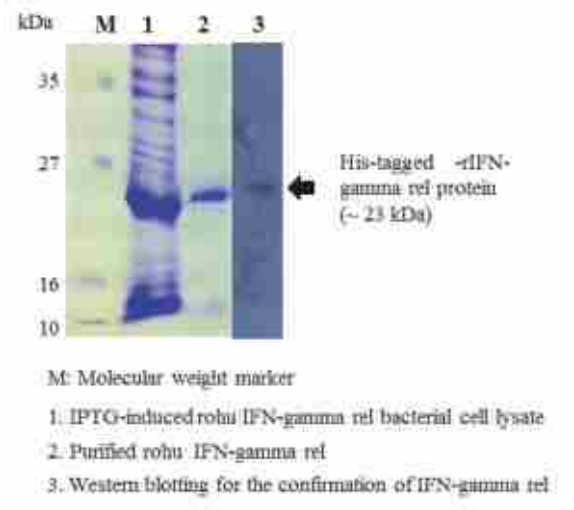


Fig. 48.

Project Title	:	National surveillance programme on aquatic animal diseases (Sub-Project 2: Surveillance of freshwater fish and shellfish diseases in Odisha and Andhra Pradesh and Sub-Project 26: National Referral Laboratory for Freshwater Fish Diseases)
Project Code	:	E-86
Funding Agency	:	NFDB
Duration	:	April 2013 – March 2017
Project Personnel	:	P. K. Sahoo (PI) and B. K. Das

For both passive and active surveillance of aquatic animal diseases, the districts covered in Odisha were Jagatsinghpur, Cuttack, Puri, Khurda, Nayagarh, Sambalpur and Baragarh and Andhra Pradesh were East Godavari, West Godavari, Krishna, Guntur and Nellore.

Total number of farms visited and farmers met

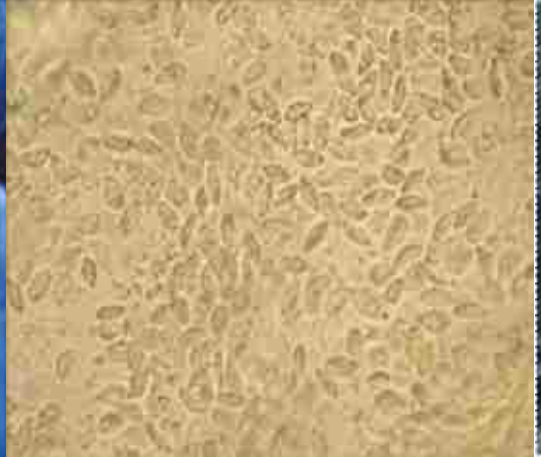
During the period, base-line data of 301 farms (West Godavari: 34, East Godavari: 24, Nellore: 34, Guntur: 25, Krishna: 41, Jagatsinghpur: 10, Balasore: 54, Puri: 13, Khurdha: 15, Baragarh: 10, Sambalpur: 5, Deogarh:3 Kendrapara 7, Bhadrak: 10; cuttack: 16) were generated. A total of 21 meetings/scientist-farmers interactions meets, particularly on farmers awareness programme on disease and disease related issues were organized in the two states.

Diseases reported and samples collected:

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

Under active surveillance programme, using level III diagnosis, the diseased samples received or collected from different places were screened, the details of which are: No. of farms visited: 109, No. of samples collected: 526 & No. of samples screened: 347. Out of above screened samples, 190 samples were found to be negative for SVCV, 182 for KHV and 2 for MrNV. Three cases of bacterial mortality were found due to *Aeromonas hydrophila*, *A. sobria* and *A. caviae*.

Myxobolous sp. infected *Labeo rohita* gill



Spores stained with Ammonium picrate

D. catlaius infection in *Catla catla*

Project Title	:	Integrated Disease management in Freshwater Aquaculture
Project Code	:	I-88
Sub-project title	:	Characterization of gill associated fish pathogens and development of methods for their diagnosis and control measures
Sub-project title	:	I-88(a)
Funding Agency	:	Institute-based
Duration	:	April 2014 – March 2017
Project Personnel	:	S. S. Mishra (PI), B. K. Das, P. Swain, P. K. Sahoo, S. K. Swain, S. Adhikari, M. Samanta and Rakesh Das

Twelve bacterial isolates belonging to the genus *Aeromonas* (03), *Pseudomonas* (03), *Staphylococcus* (02), *Streptococcus* (03) were isolated from diseased rohu and catla collected from culture ponds, showing gill lesions. The bacterial isolates were characterized by biochemically. The antibiotic sensitivity was performed against the twelve bacterial isolates. The results showed that the isolates have multiple antibiotic resistance pattern against commonly used antibiotics. The fish received from the farmers showing parasitic infection in the gills were examined and found that the parasites belong to genus *Myxobolus, Dactylogyrus* and *Ergasillus*. Further, molecular characterisation of 18S, 28S and ITS regions were done for the genus *Myxobolus*. The *Myxobolus* species isolated from the gills of rohu after morphological characterisation found to be a new species.

During the period, 11 cases of gill fluke infection caused by *Dactylogyrus* sp. and 5 cases of *Myxosporideans* infecting gills of Indian major carps were examined in the laboratory and suggestive remedial measures were provided to the farmers for their control. The gill fluke infection was more prominent in catla than other two Indian major carp species. The affected gills showed hyperplasia of lamellar epithelial cells and fusion of secondary lamellae in most instances. Myxosporideans were more common in carp fry and fingerlings. One case of massive disease outbreak in goldfish and in another case with rohu mortality, the viral involvements were suspected and the same are under further investigation.

The water quality parameters like total alkalinity, ammonia, nitrate nitrogen, free carbon-di-oxide, conductivity, salinity etc. were measured for all water bodies from where the samples were collected throughout the duration of the project to record the variation during the infection (Table 26).

Table. 26. Details of the parasite (*Myxobolus* spp.)

Characterisitcs	Range (mm)
Length of spore (LS)	8.82 ± 0.13
Width of spore (WS)	4.89 ± 0.12
Length of Polar capsules (Left)	4.74 ± 0.13
Lenght of Polar capsules (Right)	4.72 ± 0.13
Width of Polar capsules	3.45 ± 0.12
LS/WS	1.8 ± 0.08
Intercapsuler Process	absent
No. of Coils of polar filaments	4-6

Sub-project title	:	Development of biocontrol agents against important fish pathogens and their application in aquaculture
Sub-project title	:	I-88(b)
Funding Agency	:	Institute-based
Duration	:	April 2014 – March 2017
Project Personnel	:	B. K. Das (PI), S. S. Mishra and Rakesh Das

Bacillus subtilis (AN11) was characterized both morphologically based on the biochemical characters and molecularly based on the 16s rRNA and the sequences was submitted to the Genbank (accession no. JX86084). To screen the in-vitro antagonistic effect of *Bacillus subtilis* (AN11), the inhibitory test was studied against some pathogenic bacterial strain viz., Gram negative strains of *Aeromonas hydrophila* KJ459001 (CAHHI), *Pseudomonas aeruginosa* (ATCC 35072), *Edwardsiella tarda* JX280148 (CETMTI), *Vibrio parahaemolyticus* JF966211 (CPVP7) *Flavobacterium columnare* KF051085(CFCCO41) and Gram positive bacterium *Staphylococcus aureus* (ATCC6538). Four different fractions of cellular component (i.e. whole cell product, heat killed whole cell product, extracellular product, outer membrane protein) of *B. subtilis* (AN11) were tested for their antagonistic effect. The results showed that except ECP all three were effective in reducing the growth of bacterial pathogens except *Aeromonas hydrophila*. OMP showed more inhibitory effect to all the pathogens. Over a period of 96 h, the growth of the all the pathogens were reduced significantly in OMP enriched bacterial culture. All the above three new bacterial strains were isolated and conventional characterization done. The isolated bacterial strains viz.,Two numbers of *pseudomonas* spp., and one numbers of *Streptococcus* spp. were used to study the antagonistic activity in *in-vitro* condition against the fish pathogenic bacterial strains like *Aeromonas hydrophila*, *Edwardsiella tarda* and *Vibrio parahaemolyticus*. Results showed that *Pseudomonas* spp. has greater antagonistic activity against fish pathogenic bacteria *Edwardsiella tarda* followed by *Vibrio parahaemolyticus* and *Aeromonas hydrophila*.

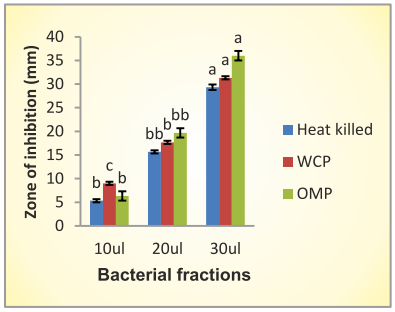


Fig. 49. Zone of inhibition (mm) of *Bacillus subtilis* AN11bacterial against *E. tarda*

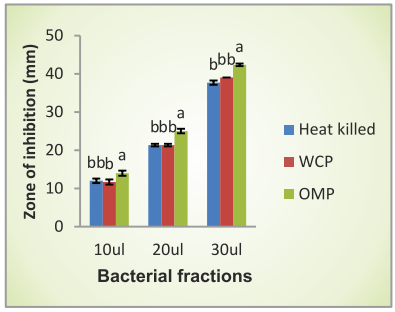


Fig. 50. Zone of inhibition (mm) of *Bacillus subtilis* AN11fractions against *V. parahaemolyticus*

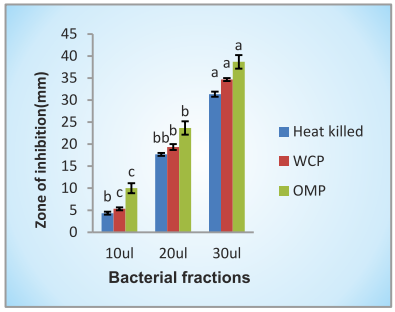


Fig. 51. Zone of inhibition (mm) of *Bacillus subtilis* AN11fractions against *P. aeruginosa*

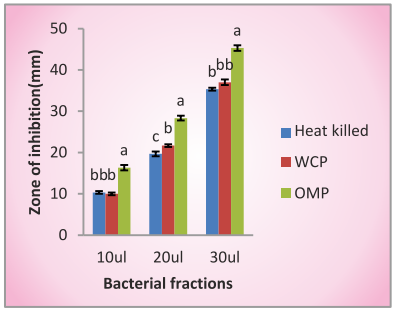


Fig. 52. Zone of inhibition (mm) of *Bacillus subtilis* AN11 against *F. columnare*

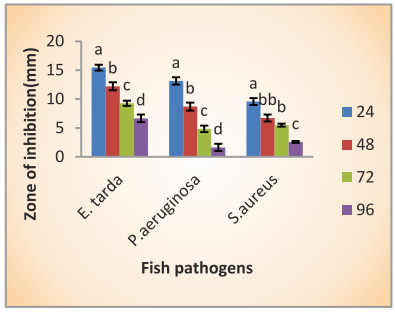


Fig. 53. Antimicrobial effect of *B. subtilis* against *E. tarda*, *P. aeruginosa*, *S. aureus* in terms of zone of inhibition

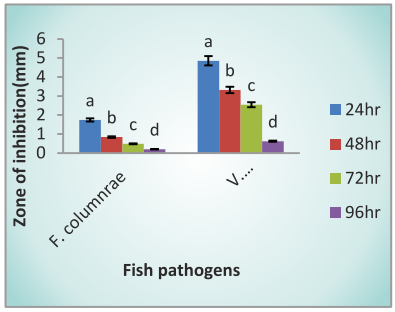


Fig. 54. Antimicrobial effect of B. subtilis against *F.columnarae* and *V.parahaemolyticus*, of zone inhibition at various time intervals

Field Visits Conducted:

Investigating the causative agent in live fish as disease outbreak occurred at farmers field Baliput, Puri district, Odisha.

On site testing of water quality parameters like water pH, Total Ammonia, Total alkalinity, Nitrite-N and giving suggestion to farmers for remedial purpose.

Sub-project title	:	Bacterial bioremediation of inorganic pollutants with special reference to ammonia & lead from freshwater ecosystem
Sub-project title	:	I-88(c)
Funding Agency	:	Institute-based
Duration	:	April 2014 – March 2017
Project Personnel	:	N. K. Maiti (PI), S. Mohanty, S. Adhikari and Bindu R. Pillai

Wastewater and sediments were collected from 10 different sites around Bhubaneswar. 1 ml of wastewater was added to Varsate media (enriched media) and subcultured 5 times at the interval of 7 days. The 63 bacterial isolates were obtained out of which 36 bacterial isolates possess heterotrophic nitrogen removal activity. Genomic DNA was isolated. 16s rDNA and gyrB genes were selected for identification of bacteria. The results obtained from both the markers were found to be well consistence. Nitrification activity was tested at concentration of 100-120 mg/l of NH_4^+-N. Total nitrogen was removed within 30- 48 h of incubation. Denitrification activity was tested at concentration of 50-120 mg/l of NO_3--N or NO_2—N. Total nitrogen was removed within 30-96 h of incubation. Out of 36 bacterial isolates, 10 showed both nitrification and denitrification activity. Ten isolates showed production of extracellular polymeric substances (Fig. 55) and 7 isolates showed tolerance to lead (100 mg/l).

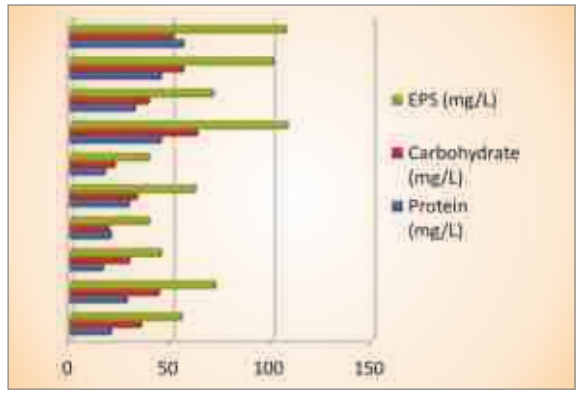


Fig. 55. Visual aggregation and whole-cell hydrophobicity assay of the isolates

E. Social Sciences

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, A. K. Das, N. Panda, U. L. Mohanty, P. R. Sahoo, S. Behera and D. P. Rath

Economic Development

1. Fish harvest in Jaipur village

- Three harvests were made on 17th & 20th May and 30th June 2014
- Total fish harvested was 2.15 quintal
- Net profit of Rs. 7,232 was earned. The profit money was deposited in the SHG Bank Account

2. Harvest in Paribasudeipur on 28th August 2014

There were six nettings during the period under report. A total of 360 Kg fish was harvested and sold @ Rs. 50-70/ Kg. Net profit of Rs. 21, 600 was earned which was partially distributed among the group members and the rest was deposited in SGH bank account.

CIFA's Interventions

Visits, interaction and monitoring:

Regular visits were made to the pond sites for monitoring the fish culture, soil and water testing by the farm women and interaction with the WSHGs for problem solving.

Post-harvest and value addition technology:

Hands-on training on post-harvest and value addition technology imparted to 60 women members during 18-19 July, 2014 at ICAR - CIFA. The members were motivated to prepare fish filleting, fish papad, fish pickle, fish balls and fish cutlets by themselves.

It was felt that there were several reasons hinder the Women Self-Help Groups to do sustainable aquaculture. Involvement of political people and their male counterparts for taking pond under lease in Jaipur village are some of the reasons. Hence they have initiated coir making and allied handicrafts, horticulture as well as paddy culture to meet their livelihood. In two other villages, scarcity of water is a major problem. To support their livelihood in Fakirpada, the beneficiaries have been involved in Mid-Day meal programme for Govt. Primary School of the village. In Paribasudeipur, the beneficiaries have initiated horticulture. They have also prepared the fish hydrolysate at pilot scale and used it for prevention of insect pests. But, all the SHGs have been motivated to be involved in aquaculture adopting spawn to fry and fry to fingerling culture with ICAR-CIFA technology as these are the profitable business in less time. Also, they are being guided to undertake post-harvest technologies as a stay for their regular livelihood practices, and to initiate it from their own families and SHGs. They were also guided to utilize the fish waste from domestic use and village markets around for fish hydrolysate which is a proven bio-fertilizer for multipurpose applications, which they were trained during last training programme in July, 2014. At the end, this will be one step ahead of "Swatch Bharat".

Hands on training to women beneficiaries on post-harvest and value addition technology of freshwater fish

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 ex-ante basis. The data from the early adopters will be taken as sample to build the impact assessment model. In the project 6 farmers each from Odisha and Tripura were collected to assess the impact of murrel and pabda, respectively. Under the project, the economics of culture of these species were estimated. The constraints in adoption was studied to develop a strategy paper for the dissemination of these species

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, A. S. Mahapatra and N. Panda

CIFA established two Aquaculture Field Schools (AFS) at well-established fish farms (AFS, Sarakana in Balianta Block and Bhataparagarha in Banapur Block) in Khurda district of Odisha. Assessed the impact of AFS on the socio-economic conditions of the farmers by doing scientific aquaculture practice. The survey was conducted in AFS, Sarakana, in Balianta Block and AFS, Bhataparagarha in Banapur Block of Khurda district of Odisha and 50 farmers from each AFS were interviewed with the help of a structured questionnaire. The socio-economic profile of the farmers reveals that on an average 47.8% (highest) of farmers were in the age group of 30-40 years in Sarakana and Bhatpadagada villages. The family size of 78.4% farmers of Sarakana and Bhatpadagada was equal to or more than 4 members. As far as educational level is concerned, an average of 49.5% (highest) of farmers were graduate in these two villages followed by secondary level (19.0%). An average of 23.7% (highest) of farmers were having agriculture & fishery as primary occupations. The 50.9% of the farmer are cultivating fish culture in an area of 2-4 ha of farm. An average of 65.2% farmers (highest) were doing carp culture followed by carp & prawn culture (23.2%). An average of 48.5% farmers attended AFS for 5-10 years and 68.2% of total farmers came to know about AFS through fellow farmers. An average of 66.6% of farmers motivated by their fellow farmers. An average of 40.9% of farmers attended AFS annually (highest) followed by 27.8% farmers to attended half yearly. An average of 66.5% of farmers opined that Scientists were the facilitators of AFS and 69.4% of farmers agreed for discussion at AFS brought about advisability for new practice. The 51.8% of total farmers were having opinion that scope for interaction was the mode of attraction towards AFS. On an average, 66.7% of farmers (highest) were having the opinion for establishment of AFS in more numbers in every Block followed by every Panchayat (24%) in Sarakana and Bhatapadagada villages.

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	:	N. K. Barik (CPI), P. Swain, S. Adhikari, P. Routray, B. C. Mohapatra, K. C. Das, P. N. Ananth and P. Jayasankar (PL)

Developed Business Planning and Development (BPD) Unit of ICAR-CIFA as new model for the technology transfer. BPD of CIFA proved itself to be an effective unit for business development by registering 7 new incubatees i.e. M/s Aisharya Aquaculture Pvt Ltd, M/s Keshar Sweet Water Fish Products, RRA Network, M/s M.R. Aquatech, M/s Smruti Agency, M/s Prabhakar Fish Pickle and M/s Poonam Fisheries within a span of eight months of its operation. The support services were also provided to them for product and business development. Business Development in terms of networking, market assessment and credit access was facilitated for commercialized technologies i.e. Portable FRP Magur Hatchery, Immunoboost-C, Portable FRP Carp Hatchery, CIFABROODTM. Dissemination of an innovative way of fish waste management by converting fish waste into biofertiliser which can be used for fertilization of field and horticultural crops.

F. Application of plastic in aquaculture

Project Title	: Application of plastics in Aquaculture
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 and D. Majhi

Polytent solar drier (PSD) for fish

Markendi (small indigenous fish) was tried to develop dry fish in a Polytent solar dryer (PSD). Six hours of active drying (9 AM to 5 PM) was taken for the experiment. During the active drying period in April – May, 2014, the outside temperature range was (38-44 ^{0}C); inside temperature (48-56 ^{0}C) and drying rate was calculated to be 60 g/hr. Initial moisture of 75.5% in the markendi fish was reduced to 8.1% after 12 h of active drying, giving an excellent dry fish.

Lab experiment for study of productivity of water by using fish hydrolysate

Fish hydrolysate is the product prepared from the fish waste produced during dressing of the fish during marketing. A preliminary experiment was designed to study the efficacy of fish hydrolysate for productivity enhancement of water in laboratory in jars. It was conducted in duplicate by taking glass jars filled with 20 L of pond water in each. The concentrations of the fish hydrolysate were 0.01, 0.05, 0.25, 1.25, and 6.25 ml/l of pond water. More chlorophyll was found in 0.25 and 1.25 ml/l concentrations. In one month duration the developed plankton in 1.25 - 6.25 ml/l concentration was seen completely decomposed.

Periphyton production on different colored plastic sheets in freshwater ponds

The experiment taking different colored plastic sheets (green, blue, black, white & red) and bamboo mats for periphyton growth on those in ponds (one stocked with fishes and the other without fish) was conducted. In bamboo mat and black colored plastic sheet the light didn't penetrate to the back side, so there was no periphyton growth on them (in the back side). Blue color had more amount of periphyton growth on it. The pond stocked with fish had quantitatively low amount of periphyton on it than the pond having no fish. The 46.36% less periphyton was observed on sheets in ponds with fish, which means fish had consumed the periphyton (Table 30).

Table 30.

Colour of plastic sheet	Quantity of Periphyton (in ml) on sheets- Pond with fish	Quantity of Periphyton (in ml) on sheets - Pond without fish
Red	4.5	6.5
Green	5.5	8.0
Blue	5.0	13.5
Black	4.5	7.0
White	4.5	12.0
Bamboo sheet	5.5	8.0

Two ponds of 0.1 ha each were selected for this experiment. One pond had five different colour plastic sheets for periphyton growth and another without plastic sheets. Each pond was stocked with 50 kg of fish (body wt of rohu 600-900 g). The fishes were reared for three months and supplementary feed was given in both the ponds with 2% fish biomass. The water parameters of both the ponds showed no significant difference. At the end of the experiment, 79 kg fish was harvested form pond with plastic sheet and 72 kg fish from the pond without plastic sheets. The pond with plastic sheets had 9.72 % higher growth rate than pond without plastic sheet

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 and B. K. Pandey

Experiment on production of plankton by using different animal waste

Experiment on standardization of plankton culture using different animal wastes e.g. poultry litter, cattle dung, poultry dung + cattle dung in different treatments has been done. Mixture of cattle dung + poultry litter @ 0.005 kg (Cattle dung, 0.0025 kg + Poultry litter 0.0025 kg) exhibited the best performance in producing plankton measuring 1580 numbers L^{-1}. The dose (0.005 kg /100 L water) of animal waste mixture applied correspondences to application of 500 kg ha^{-1} water area. The experiment suggests that combination of cattle dung and poultry litter may be applied in fish pond to increase the production of plankton.

Experiment on economic analysis and cost-benefit analysis of different cropping system

An experiment was set up to find out economical input and output relationship among the different farming system models. In this experiment, three types of cropping patterns i.e. mono cropping, improved cropping and integrated cropping were evaluated. Three sites were selected for the experiment having 0.15 ha area where 0.1 ha water area and 0.05 ha was pond dyke. In case of mono cropping, the pond was utilized through traditional composite fish farming using rohu (*L. rohita*), catla (*C. catla*) and mrigal (*C. mrigala*) but pond dyke was unutilized throughout the year whereas in case of improved cropping pond was utilized for carp culture and pabda (O. bimaculatus) as additional species. In this case pond dykes was partially utilized for cultivation of both summer and winter seasons high value Agri-horti crops i.e., corn, sunflower, cherry tomato, red cabbage, broccoli and strawberry. But during integrated farming the duck (khaki campble variety) was introduced along with other components utilized in improved cropping. The cumulative result of two years showed that B/C ratio of integrated farming was higher than the other two cropping systems.

Table 31. Cumulative result of integrated farming

	Mono cropping*	Improved cropping**	Integrated cropping***
Cost of Cultivation	Rs. 38,700.00	Rs. 62,525.00	Rs. 77,503.00
Gross return	Rs. 48,615.00	Rs. 1,06,284.00	Rs. 1,54,765.00
Net return	Rs. 9,915.00	Rs. 43,759.00	Rs. 77,262.00
B:C ratio	1.26	1.69	1.99

*Monocropping: Only fish culture in 0.1 ha water body and remaining 0.05 ha unutilized.

**Improved Cropping System: Fish culture in 0.1 ha water body + Agri-horti Crop in remaining 0.047 ha pond dyke area.

*** Integrated Farming System: Fish culture in 0.1 ha water body + Agri-horti Crop & livestock in remaining 0.05 ha pond dyke area.

Breeding of *Pabda* without sacrificing the male

An experiment has been conducted at this centre for seed production of a variety of pabda collected from Northern part of West Bengal. During the experiment, 2 nos. of males having average l/w 12.05 cm/24 g. and 2 nos. of females having average l/w 12.5 cm/27 g. were used. In this case, male was not sacrificed. A tranquilizer was used during injecting the male and female and as a result the male and female responded spontaneously. There was no need of stripping of female and also no need of dissection of male to collect the testes. After fertilization about 2500-3000 spawns were produced, out of which about 1500 fingerlings have been recorded and their rearing is in progress in rearing tank. At present the average l/w of this species is 9 cm/6 g.

Feeding trial of *Pabda* by using aquatic macrophyte

The experiment to evaluate the growth performance of advanced fry of *Ompok bimaculatus* fed with typical aquatic macrophyte, tubifex worms and boiled chicken viscera under pond condition has been completed. During the experiment five treatments were kept and each with three replicates. Individual treatments with aquatic macrophyte, tubifex worm and boiled chicken viscera was done along with two separate treatments using tubifex and aquatic macrophyte; chicken viscera with aquatic macrophyte was also taken for getting the experimental outcome. It has been found that this species consumes a typical macrophyte and this type of weed can be used as feed supplement resulting the reduction of feed cost for culture of pabda.

Project Title	:	Stock characterization, captive breeding, seed production and culture of hilsa (Tenualosa ilisha)
Project Code	:	E-78
Funding Agency	:	NFBSFARA
Duration	:	November, 2012 – 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).

Artificial fecundation of Hilsa

Four breeding trials were conducted as per the availability of fully ripe fish in river Hooghly at Godakhali, West Bengal during October 2014 and February 2015 with 93-95% fertilization rate. The fertilized eggs of hilsa produced in October 2014 were transported and incubated in cemented hatchery at Rahara and Kalyani and also in rectangular FRP tanks at Kalyani. The average size of matured males were 267.2 mm/188.78 g (range 233-315 mm/130-245.7 g) where as the only fully ripe female was 330 mm/417.3 g. Hatching rate under laboratory condition was 34%. During February 2015, the average size of matured male was 273.8 mm/191.15 g (range 241-310 mm/ 135-289 g) where the female was 313.7 mm/363.9 g (range 305-345 mm/262-547 g). The fertilized eggs were transported to RRC, CIFA, Kalyani and incubated in glass aquaria using river water after filtering in sand and gravel based filter. Hatching rate under laboratory condition was 98%.

Oozing female and male hilsa

Rearing of larvae

The hilsa larvae obtained from artificial breeding on 22.02.14 at Godakhali, attained the a size of 54.38 ± 2.84 mm/1.35 ± 0.23 g in 65 days in rectangular FRP tank. To observe the feeding behaviour, the newly hatched larvae of October 2014 were reared in glass battery jars and glass aquaria using settled river water with provision of aeration. Mouth movement was first observed on 4th day old larvae. Larvae were provided with rotifer, finely sieved artemia nauplii paste, tubifex paste, powered feed and boiled egg yolk. Particles of finely powdered feed and artemia paste were found in the delicate guts of larvae. The larvae did not survive beyond eight days of rearing in aquaria and glass battery jars. However, few larvae survived in rectangular FRP tank up to 34 days. The larvae produced during February 2015 were stocked in rectangular FRP tank, circular FRP tank, circular FRP silos, nursery ponds and concrete reservoir at different stocking densities to study survival, growth performance and feeding behaviour. Analysis of gut content showed that initially they consume chlorella and afterwards as they grow the major food content consist of diatoms, rotifers, scenedesmus, pandorina, daphnia, euglena, coelastrum and spherocystis. The larvae showed strong attraction towards artificial fluorescent light. The larvae grew to 12-41 mm/0.009-0.25 g in different tanks in a month. The culture is in progress.

3-day old larvae

Chlorella culture for feeding Hilsa Larvae

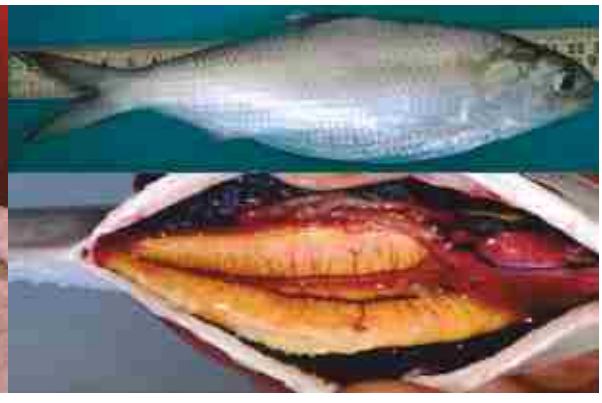
Hilsa culture in nursery pond

The wild caught hilsa seed (65.72 ± 2.18 mm/ 2.4 ± 0.23 g) were stocked @ 50,000 nos/ha in earthen nursery pond (0.01 ha area, 1.2 m depth). Fishes were provided regularly with mixed planktons collected from plankton culture cisterns and other ponds. During five months culture period, fish grew to 151.7 ± 5.85 mm/45.15 ± 4.1 g with 9.6 % survival.

Grow out culture of hilsa

The wild caught hilsa seed (81.11 ± 1.88 mm/ 5.4 ± 0.4 g) were stocked @ 20,000 nos/ha in concrete lining grow out pond (0.1 ha area, 1.9 m depth). Fishes were provided regularly with mixed planktons collected from plankton culture cisterns and other ponds. During 12 months culture period the fish grew to 218.43 ± 2.86 mm/106.63 ± 4.78 g. In grow-out pond, few female hilsa were found with developing eggs at the stage between IV-V after 8 months culture. Culture is in progress.

Hilsa grown in freshwater pond



Pond grown hilsa with developing eggs

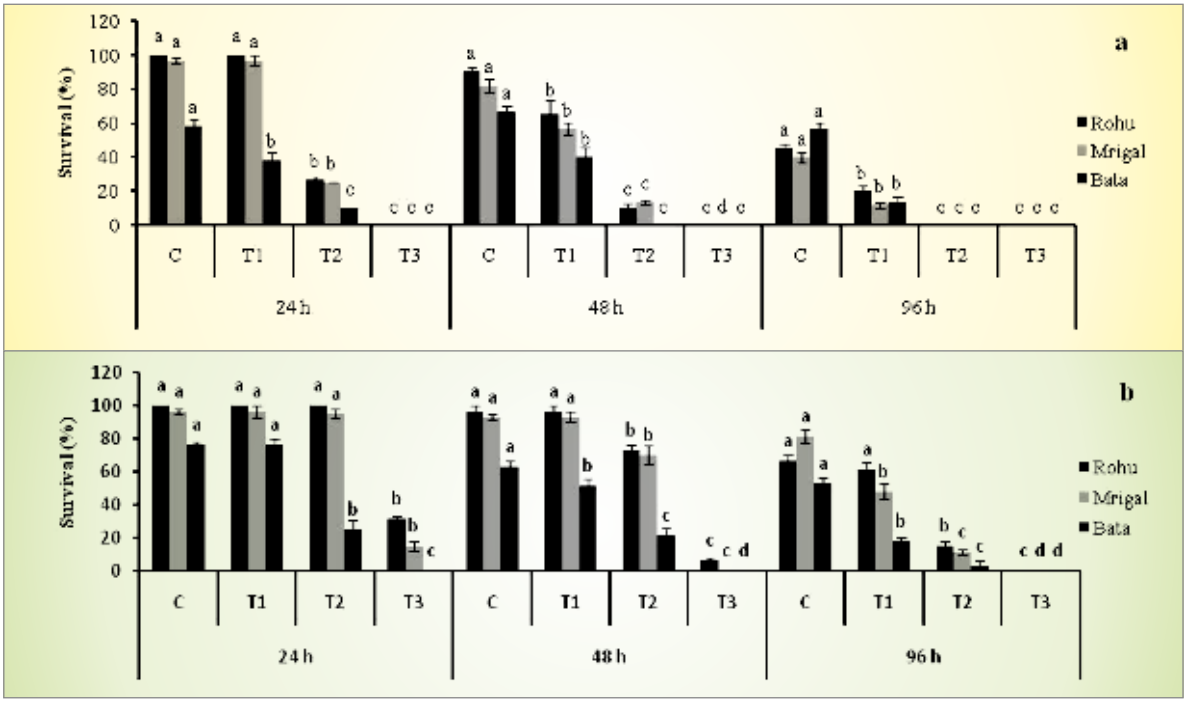
H. Regional Research Centre, Rahara

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 and B. K. Pandey

Tolerance of fish to different doses of sewage effluent

Survival (%) of various age groups (3 d, 10 d, 30 d and 45 d) of *L. rohita, C. mrigala* and *L. bata* were observed after 24, 48 and 96 h of stocking in freshwater fed with sewage effluent at different sewage concentrations (25%, 50%, 75% and Control). Mortality of 3 days old spawn was found 100% after 96 h in different treatments, except control group (the survival range was recorded between 40-56.7%). In the second trial, survival (%) of 10 d old fry was found much higher after 24 and 48 h of stocking than that found in the first trial (3 d spawn). In the third trial with 30 d old fry, all the treatments showed very high survival (%) with no significant difference ($P<0.05$) up to 48 h of stocking. However, survival (%) was found different among treatments after 96 h of stocking. In the fourth trial, survival (%) of 45 d old fingerlings was also found to be very high up to 48 h of stocking. However, fish survival (%) was found less than 50% in all the treatments after 96 h.

This experiment concludes the following: i) unsuitability of 3 d, 10 d, 30 d and 45 d old fish juveniles for stocking in sewage fed water, ii) low tolerance of *L. bata* spawn to sewage effluent as compared to L. rohita and *C. Mrigala*, iii) tolerance limit of fish to sewage concentration increases with age and iv) more than 45 d or nearly two months old fingerlings may be reared in sewage fed water subjected to intake of 50% sewage with BOD level around 24 mg/l.



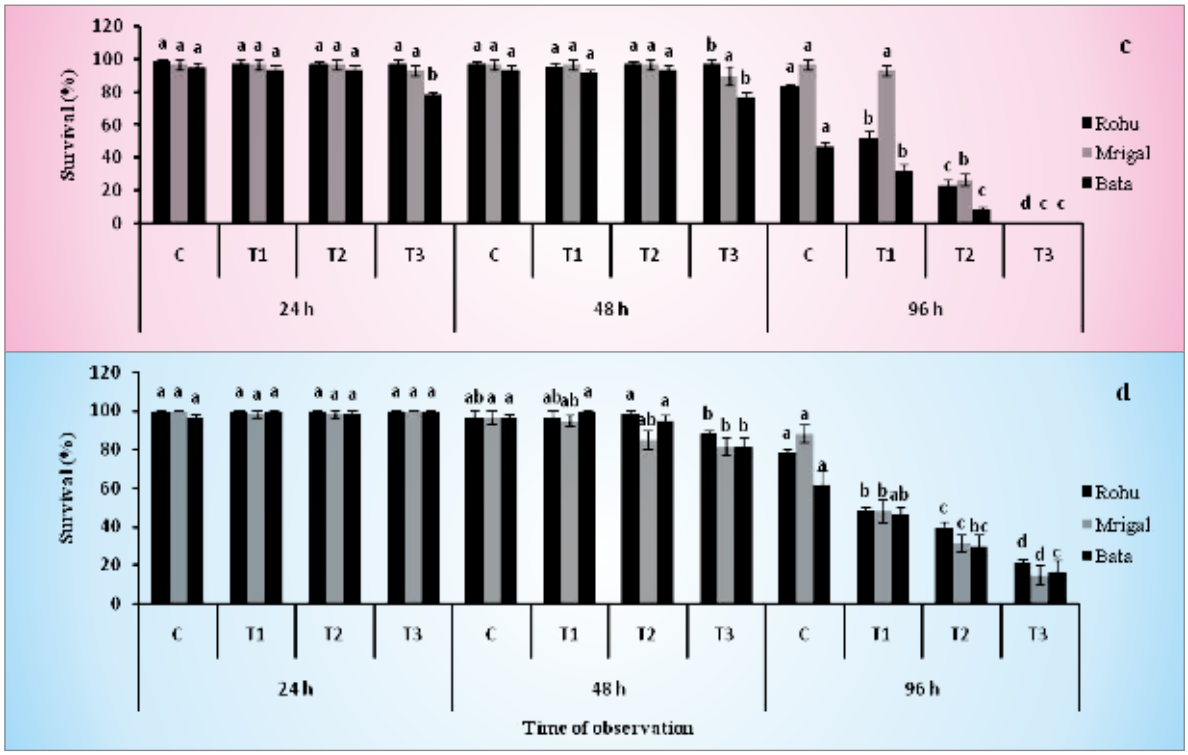


Fig. 56. Tolerance limit of fish species (rohu, mrigal and bata) with different age groups (Fig. a-3d; Fig b., 10d; Fig c., 30d and Fig d., 45d) recorded from sewage concentrations (control, 25%, 50% and 75%).

Field trial of fish cultivation in STP pond at IARI, New Delhi (Toxicity test through Bioassay trial)

Different fish species (wt. ranged between 10 -18 g) including catla, rohu, mrigal, silver carp and grass carp, each with 10 numbers, were released in three different treatments (100%, 50% and 25%), each with three replicates. Fish survival was recorded in the range of 60-71.4% in three different treatments. Growth of Pangas has been recorded in the range of 200- 300 g from initial 5 g over 3.5 months of culture, with 80% survival. The values of DO in culture water ranged from 8.8 to 14.2 mg/l, with suitable pond productivity showing the values in the range of 340-425 mg C/m^3/h (GPP) and 150-350 mg C/m^3/h (NPP) and pH measured as 7.2.

Pollution study showed that BOD5 varied in the range of 25-40 ppm, with total heterotrophs (cfu/ml), 1.3 × 103 (NA medium) and total coliforms (cfu/ml), 1.1 × 103 (LBL medium). Heavy metals were recorded from fish muscles in the following range: Ni, 0.32-0.41 ppm; Mn, 0.11-0.18 ppm; Zn, 0.42-1.04 ppm; Fe, 0.96-1.1 ppm; Pb, 0.1-0.44 ppm; Cu, 0.08-0.23 ppm; Co, 0.08-0.29 ppm; Cd, 0.03-0.34 ppm.

The experiment concludes the following: i) intake of sewage facilitated the water productivity, with the concomitant effect of different water parameters conducive to fish rearing, ii) microbial load recorded is under safe limit in hygienic point of view, iii) all these metal concentrations found in fish muscles are measured to be safe for human consumption.

Effect of sewage application on physico-chemical changes

Intake of sewage caused much change in hydro-biological parameters in sewage fed treatments compared to those in control treatment. The value of DO varied in the range of 5.1- 7.1 mg/l, showing much increasing trend compared to DO value (4.0 mg/l) recorded in control. In 50 % sewage fed culture water, BOD values ranging from 23.0 to 24.4 mg/l were found below the lethal concentration of fish survival. The values of ammonia nitrogen in the range as 0.87-0.99 mg/l and phosphate as 0.17 mg/l were found congenial for fish survival and growth.

Table 32. Physico-chemical parameters of culture water in different treatments during experimental period of 90 days

Parameters	Control	T_1	T_2	T_3	T_4	T_5	T_6
Temperature (ºC)	$31.8^{a} \pm 0.4$	$31.8^{a} \pm 0.4$	$31.8^{a} \pm 0.4$	$31.8^{a} \pm 0.4$	$32.9^{a} \pm 0.3$	$32.9^{a} \pm 0.3$	$32.9^{a} \pm 0.3$
pH	$6.73^{ab} \pm 0.04$	$6.78^{abc} \pm 0.07$	$6.73^{ab} \pm 0.06$	$6.65^{a} \pm 0.03$	$6.91^{cd} \pm 0.04$	$7.00^{d} \pm 0.04$	$6.84^{bc} \pm 0.05$
DO (mg/l)	$4.02^{a} \pm 0.1$	$5.15^{b} \pm 0.3$	$6.35^{cd} \pm 0.3$	$6.73^{de} \pm 0.3$	$5.85^{c} \pm 0.2$	$6.83^{de} \pm 0.3$	$7.10^{e} \pm 0.2$
BOD (mg/l	$3.08^{a} \pm 0.3$	$10.83^{b} \pm 0.2$	$23.0^{c} \pm 0.5$	$56.17^{d} \pm 1.2$	$24.42^{c} \pm 1.0$	$24.25^{c} \pm 0.9$	$24.17^{c} \pm 1.1$
Alkalinity (mg/l)	$132.9^{a} \pm 1.6$	$134.6^{a} \pm 2.5$	$136.7^{a} \pm 2.9$	$167.5^{b} \pm 6.2$	$130.4^{a} \pm 2.6$	$133.3^{a} \pm 2.8$	$137.8^{a} \pm 2.2$
NH_4-N (mg/l)	$0.13^{a} \pm 0.01$	$0.68^{b} \pm 0.07$	$0.88^{bc} \pm 0.09$	$1.26^{d} \pm 0.05$	$0.87^{bc} \pm 0.09$	$0.97^{c} \pm 0.08$	$0.99^{c} \pm 0.08$
P_2O_5 (mg/l)	$0.04^{a} \pm 0.005$	$0.13^{b} \pm 0.005$	$0.17^{b} \pm 0.006$	$0.28^{c} \pm 0.048$	$0.17^{b} \pm 0.005$	$0.17^{b} \pm 0.005$	$0.17^{b} \pm 0.004$
Phytoplankton (×1000/l)	$18.13^{a} \pm 0.8$	$45.0^{b} \pm 1.4$	$81.67^{c} \pm 2.5$	$99.75^{d} \pm 3.3$	$95.0^{d} \pm 5.1$	$94.17^{d} \pm 4.6$	$99.08^{d} \pm 3.8$
Zooplankton (×1000/l)	$10.96^{a} \pm 0.2$	$33.67^{b} \pm 0.6$	$39.92^{c} \pm 1.9$	$39.33^{c} \pm 1.3$	$41.25^{c} \pm 2.1$	$47.25^{d} \pm 1.4$	$47.58^{d} \pm 2.0$
NPP (mg C/m^3/h)	$41.7^{a} \pm 2.3$	$169.7^{b} \pm 2.2$	$192.5^{c} \pm 2.2$	$190.0^{c} \pm 9.9$	$191.3^{c} \pm 1.9$	$194.7^{c} \pm 1.3$	$202.1^{c} \pm 4.1$
Total coliform (MPN × 10^6/100ml)	0^{a}	$4.75^{b} \pm 0.5$	$5.50^{b} \pm 0.6$	$27.83^{c} \pm 2.1$	$5.17^{b} \pm 0.8$	$4.92^{b} \pm 0.6$	$4.92^{b} \pm 0.6$

Data expressed as Mean ± SE (n = 12);

Mean values with different superscript in a column differ significantly

The experiment concludes the following: i) low value of DO (4.0 mg/l) in control was due to lack of sufficient amount of phytoplankton in culture water since the control treatment was not applied with sewage, ii) application of sewage with proper loading is prerequisite to the desirable changes in sewage fed system, resulting in suitable amount of nutrients (nitrogen and phosphorus) recovery, with provision of phytoplankton production and increasing water productivity.

Single dose vs. split doses in relation to effective water productivity

Application of split dose exhibited better values of DO (mg/l) as 5.9 (D1), 7.1 (D30), 7.2 (D60) and 7.0 (D90) in different treatments. Similar trend was recorded as split doses exhibited better NPP values (mg C/ m3/h) as 190 (D1), 195 (D30), 196 (D60) and 196 (D90) in different treatments.

The experiment concludes the following: i) proper dilution of sewage is required to be mixed with freshwater, and ii) application of sewage with different doses are much effective than single dose to make the culture water conducive for fish survival and growth.

Table 33. Initial weight, weight gain and survival of fish after 90 days of rearing in different treatments

Treatment	*L. rohita*			*C. mrigala*			*L. bata*		
	Initial weight (g)	Weight gain (%)	Survival (%)	Initial weight (g)	Weight gain (%)	Survival (%)	Initial weight (g)	Weight gain (%)	Survival (%)
Control	$19.3^{a} \pm 0.4$	$55.6^{a} \pm 3.0$	$83.3^{b} \pm 4.2$	$13.5^{a} \pm 0.4$	$67.4^{a} \pm 9.3$	$79.2^{b} \pm 4.2$	$12.3^{a} \pm 1.0$	$28.3^{a} \pm 1.9$	$87.5^{b} \pm 0$
T_1	$18.6^{a} \pm 2.1$	$125.1^{bc} \pm 13.0$	$83.3^{b} \pm 4.2$	$14.6^{a} \pm 2.3$	$110.1^{abc} \pm 9.7$	$75^{b} \pm 0$	$12.3^{a} \pm 0.9$	$120.6^{c} \pm 8.7$	$79.2^{b} \pm 4.2$
T_2	$18.0^{a} \pm 1.6$	$165.9^{c} \pm 24.6$	$79.2^{b} \pm 4.2$	$15.2^{a} \pm 2.7$	$125.1^{bcd} \pm 24.9$	$75^{b} \pm 0$	$11.7^{a} \pm 0.4$	$136.9^{c} \pm 12.5$	$83.3^{b} \pm 4.2$
T_3	$19.7^{a} \pm 0.9$	$106.5^{b} \pm 10.0$	$41.7^{a} \pm 4.2$	$13.5^{a} \pm 0.4$	$93.9^{ab} \pm 0.7$	$33.3^{a} \pm 4.2$	$12.4^{a} \pm 1.0$	$89.0^{b} \pm 8.6$	$37.5^{a} \pm 7.2$
T_4	$19.9^{a} \pm 1.3$	$158.6^{c} \pm 16.6$	$87.5^{b} \pm 0$	$13.5^{a} \pm 0.4$	$147.3^{cd} \pm 16.6$	$83.3^{b} \pm 4.2$	$11.9^{a} \pm 1.3$	$133.9^{c} \pm 13.0$	$79.2^{b} \pm 4.2$
T_5	$19.5^{a} \pm 1.0$	$165.3^{c} \pm 15.2$	$87.5^{b} \pm 7.2$	$13.6^{a} \pm 0.4$	$151.8^{cd} \pm 13.6$	$83.3^{b} \pm 4.2$	$12.3^{a} \pm 1.2$	$141.2^{c} \pm 6.2$	$87.5^{b} \pm 7.2$
T_6	$19.2^{a} \pm 1.3$	$165.7^{c} \pm 17.7$	$83.3^{b} \pm 4.2$	$13.3^{a} \pm 0.3$	$157.0^{d} \pm 9.3$	$83.3^{b} \pm 4.2$	$12.1^{a} \pm 0.9$	$143.8^{c} \pm 7.3$	$79.2^{b} \pm 4.2$

Data expressed as Mean ± SE (n = 3); Mean values with different superscript in a column differ significantly.

Pesticide analysis from fish muscles

The pesticides analyses, including organochlorine, of fish samples collected from Mudiyali Fish Farm, South 24 Parganas, W. B. were done. Only DDT was found to be 0.16 mg/kg in catla, the range of 0.36 - 0.53 mg/kg in mrigal and 0.16 - 0.25 mg/kg in rohu. The study concludes that the recorded values of pesticides are much below than the safe limit for human consumption as per Food Safety and standards Authority of India (www.fssai.gov.in).

Utilization of jute leaf as alternate fish feed ingredient:

Jute leaf was analyzed to have the following nutrient composition in range: dry matter (30.90 - 32.95%), protein (14.52-15.18 %), fat (2.31 - 2.16%) and ash (8.46 - 10.50 %). The leaf was used as one of the ingredients as basal diet and fed to *Labeo rohita* fingerlings (av. wt. 16.37g) for 60 days under different feeding trials in lab condition. The experiment concludes that the leaf can be incorporated as rohu feed up to 20% level as an alternate fish feed ingredient.

I. Regional Research Centre, Bangalore

Project Title	:	Species Diversification in Aquaculture: Development of Sustainable Practices for Introduction of Peninsular Fishes in Culture Systems
Project Code	:	I-86
Funding Agency	:	Institute-based
Duration	:	April 2013 – March 2016
Project Personnel	:	N. Sridhar (PI), M. Raghunath, Hemaprasanth, B. Gangadhar and C. H. Raghavendra

Brood stock development, breeding and larval rearing of *Puntius carnaticus* and *Puntius pulchellus*

Field trip was undertaken to Gajanur and Tirthahalli areas of Shimoga district in which *Puntius pulchellus* and a few other peninsular carps (kolus and mahseer) were collected from river Tunga. In another trip to Kollegal, Mandya district *Puntius carnaticus* fingerlings and adults were collected from the river Cauvery and from Shimsha basins near Malavali the juveniles of *P. carnaticus* were collected. Adults (n = 11) and fingerlings (n = 20) were collected from Kollegal, Mandya district acclimatized and monitored for growth. The collected adults of size 19.9 ± 3.5 cm in length and 181.8 ± 71.31 g in weight attained 341.5 ± 94.7 mm in length and 324 ± 47.32 g in weight whereas the fingerlings attained 227 ± 9.94 mm in length and 122 ± 11.85 g in weight from an initial size of 13 ± 1 .43 cm in length and 19.77 ± 7.8 g in weight .The farm bred *P. carnaticus* attained a size of 194.43 g/239.6 mm to 310 mm/325 g. *P. carnaticus* males matured at an initial weight of 120 g onwards. Female specimens that have attained a weight of 300 g onwards are yet to exhibit sexual maturity.

Enhancement of maturation through feeding and hormonal inputs in the peninsular carp *Puntius pulchellus*

Adult *P. pulchellus* were reared under different feeding conditions including Azolla based feed and the behavioral pattern/ courtship/external dimorphism/milt expression with respect to the stocked male and female fishes in each pond were monitored. Female maturity was observed in the Azolla incorporated and feed containing silkworm pupae, thus overcoming the formation of visceral fat. Feeds did not affect male maturity confirmed by the development of tubercles on the snout of males. Courtship between sexes were also observed. A breeding trial was undertaken and the males responded to ovatide. The females did not respond to ovatide. Second injection led to the death of the fish revealing oocytes in different maturity stages.

Modification of RAS system and rearing of *Labeo fimbriatus* spawn in the modified RAS

Based on the work done in previous year, the RAS design was modified with respect to water entry, full bottom support for tubs and outlets. A fish hydrolyzate and yeast based diet (FPH-Y) was prepared for the larval rearing by fermentation of cooked fish meat with papain. The growth and survival of fimbriatus spawn when stocked in the modified RAS at 30 & 60 million/ha is given in Table 34. At the lower stocking density, only slightly higher survival was obtained with the FPH-Y diet, but the growth was higher both in terms of length and weight. But in case of higher stocking density survival of spawn to fry was higher in case of the FPH-Y diet by nearly 10% and correspondingly the growth was significantly lesser in terms of length and weight.

Table 34. Growth and survival of *L. fimbriatus* spawn stocked in modified RAS at 30 and 60 million/ha

		Lengths (mm)			Weight (mg/larva)		
	Survival (%)	Initial	Final	% Gain	Initial	Final	% Gain
Stocking Density : 30mil/ha							
Control	91	6	9.9	65	1.77	9.32	426
FPH-Y	93.67	6	10.85	80.83	1.77	12.42	601
Stocking Density : 60mil/ha							
Control	46.11	6.35	9.0	41.73	1.28	5.28	314
FPH-Y	56.78	6.35	8.36	31.61	1.28	5.17	304

Value added products from medium and small indigenous fish species

Two variants of a condiment (chutney powder) were formulated and prepared from two varieties of dried SIFFS that had been pre-treated using the process developed during the first year.

Carcass evaluation of *Labeo fimbriatus* and *Puntius pulchellus* were carried out. *Labeo fimbriatus* gave an yield of 39% on filleting. Of the unusable portions, frame, head and viscera accounted for 24, 16 and 10% respectively. Fins and scales together accounted for 8% of the fish, while about 2% was lost in dressing. Taste panel did not score the different body cuts differently. *Puntius pulchellus* subjected to carcass evaluation showed that the proportion of second and first body cuts in total body weight increased sharply with size of fish, but proportions of head and 3rd body cuts increased by little (Fig. 57). Moisture increased from first to third body cut, while fat declined from first to third body cut. Second body cut had highest protein and ash in the muscle.

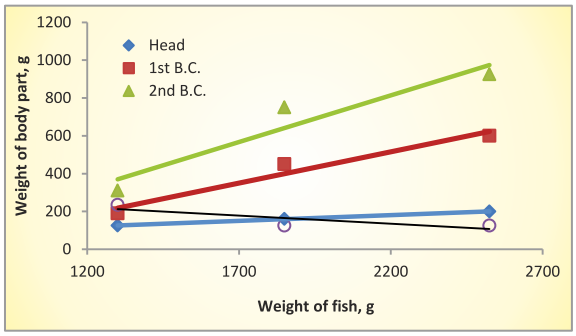


Fig. 57. Relationship of Puntius pulchellus body parts to total weight of fish

Studies on Argulus infection pattern in Peninsular carps subsequent upon their introduction to culture systems with an aim on development of prophylactic and control measures

Argulus infection pattern in peninsular carps under polyculture was studied. *Labeo fimbriatus, Tor khudree, Puntius carnatius* and *Puntius pulchellus* were maintained under polyculture (1:1:1:1) and challenged with *Argulus japonicas* metanaupli at two different dose levels. Among the Peninsular carps studied, fimbriatus was the most susceptible and carnaticus the most resistant to Argulus infection. Challenge with Argulus developmental stages resulted in mortality of fimbriatus, mahsheer and pulchellus. However, no mortality was observed in carnaticus. Susceptibility of Peninsular carps to Argulus under polyculture: carnatiucs < pulchellus < mahseer < fimbriatus, with fimbriatus being the most susceptible.

In another study, evaluated the immunization potential of UV attenuated metanauplii of Argulus and explored its efficacy in preventing further infection in L. fimbriatus. Fingerlings of *L. fimbriatus* exposed to UV irradiated metanaupli were challenged with normal non attenuated metanaupli on days 7 and 15 post initial immunization dose (UV) and studied the progress

of infection, pathology, symptoms and parasite establishment in the host. Single immunization with UV attenuated metanaupli was not 100% effective in protecting host against subsequent challenge. However, longer periods of survival of the host, milder pathology/ symptoms of the disease and lesser number of parasites established from challenge indicated the immunizing potential of UV attenuated metanaupli. Hence, studies were undertaken to evaluate the immunization potential of booster dose with UV-attenuated metanaupli. Immunization with UV attenuated metanaupli followed by a booster dose on D-15 conferred protection in *L. fimbriatus* fingerlings against subsequent challenge with lethal dose till day 45 post the booster dose.

The efficacy of Ivermectin oral administration as a prophylactic treatment in preventing establishment of Argulus infection in *L. fimbriatus* was also evaluated. Prophylactic use of Ivermectin prevented establishment of infection from challenge till 21 days post drug administration.

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

Comparative evaluation of taxonomic and biochemical composition of periphyton and plankton

Periphyton grown on sugarcane bundles was analysed for major digestive enzymes in order to quantify their possible contribution of exogenous digestive enzymes to grazing fish. The proximate composition and taxonomic composition of constituent planktonic organisms was compared with free plankton. The proximate composition analysis revealed free plankton to contain more ($P<0.05$) crude protein (37.13% compared to 26.38% in periphyton) and fat content (6.24% compared to 2.04% in periphyton) with lesser ash content (20.69% compared to 32.63% in periphyton) compared to periphyton.

The taxonomic composition of the samples revealed that the total number of planktonic species in periphyton was 80 while that in free plankton sample was only 33 belonging to 15 and 11 classes, respectively. The major classes of phytoplankton in periphyton were Chlorophyceae with 18 species (which constituted to 25% of the total species), followed by Cyanophyceae - 14 species (20%) and Bacillariophyceae – 12 species (17%). Other classes of phytoplankton recorded were Conjugatophyceae, Desmidaceae, Euglenophyceae, Ulvophyceae, Dinophyceae, Xanthophyceae, Florideophyceae and Trebouxiophyceae. The major classes of phytoplankton in free plankton samples were Chlorophyceae with 8 species (which constituted to 24% of the total species), followed by Cyanophyceae - 5 species (15%) and Bacillariophyceae – 3 species (10%). Other classes of phytoplankton recorded were Conjugatophyceae, Coscinodiscophyceae and Trebouxiophyceae.

Table 35. Proximate composition (% dry matter) of periphyton and plankton.

Sample	Moisture	Crude Protein	Fat	Crude fibre	Ash	NFE
Periphyton	80.00 ± 6.58^{a}	5.31 ± 0.14^{b}	0.4 ± 0.01^{a}	1.2 ± 0.08^{b}	6.5 ± 0.11^{b}	6.6 ± 0.06^{b}
Plankton	93.02 ± 0.94^{b}	2.6 ± 0.07^{a}	0.4 ± 0.03^{a}	0.4 ± 0.02^{a}	1.4 ± 0.09^{a}	2.1 ± 0.05^{a}

Growth performance, carcass proximate composition and gut digestive enzyme activity of *L. fimbriatus* in polyculture with *C. catla* in periphyton enhanced system

An experiment was conducted in out-door cement tanks with 2 levels of sugarcane bagasse substrate [with (2t/ha) and without] and 2 levels of feeding (with and without). Cow dung, urea and SSP applied at standard doses (CIFA, 2005). *L. fimbriatus* and catla fingerlings @ 10,000/ha in the ratio of 6:4. Fed at 5% of body weight with pelleted feed containing GNC, RB and ragi @ 45:45:10. Culture duration was 3 months. Growth of both catla and fimbriatus was poor in unfed tanks (Fig. 58). Substrate had no effect on the growth performance of catla (non-grazing habit). Fimbriatus performed equally good in substrate installed tank compared to fed tank due to utilization of periphyton. Digestive enzyme activities corroborated the fish growth.

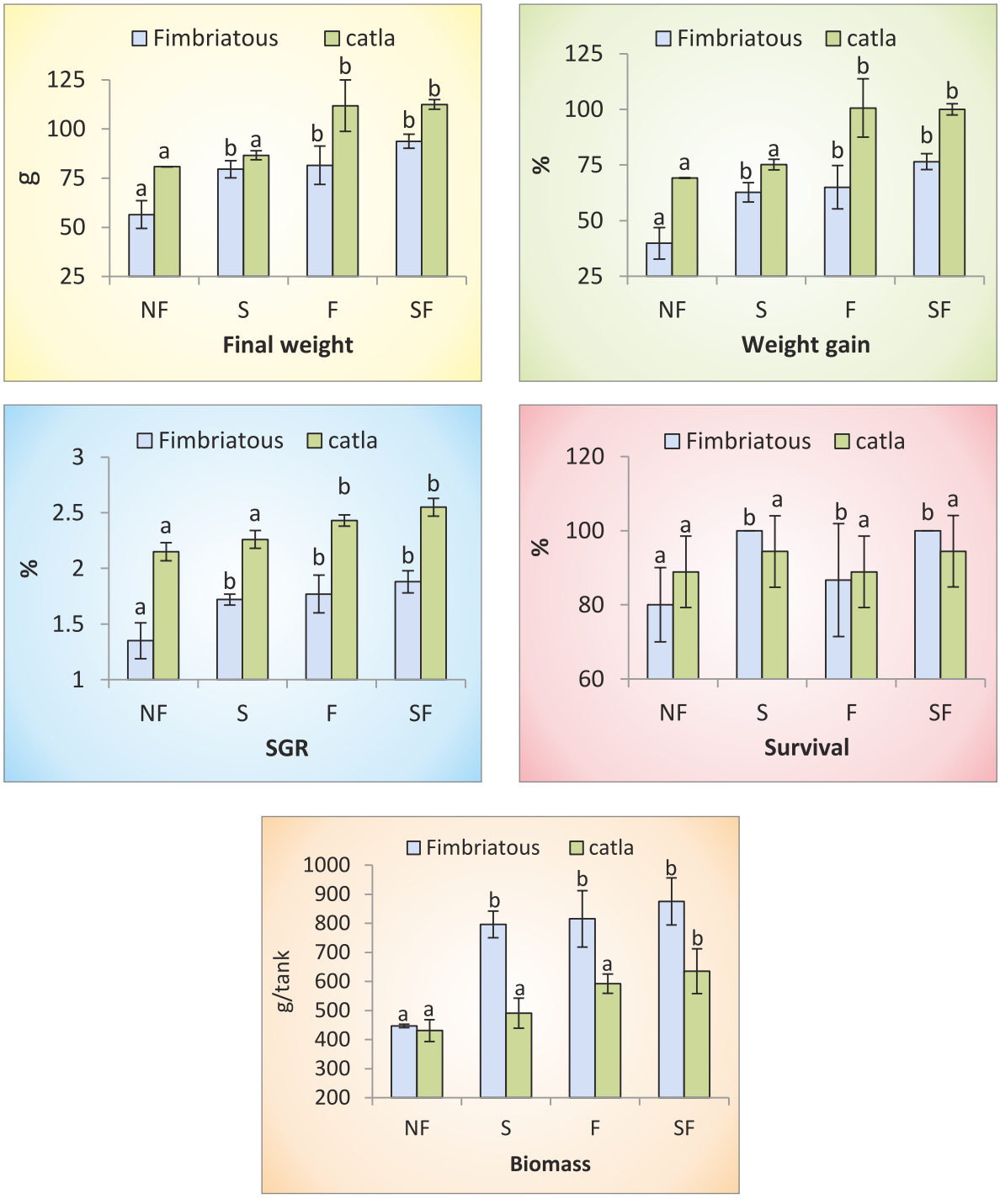


Fig. 58. Growth parameters of *L. fimbriatous* and *C. catla*

J. Regional Research Centre, Vijayawada

Project Title	: Establishment of Hatchery and Seed Production facilities for the striped catfish (*Pangasianodon hypophthalmus*) in Andhra Pradesh
Project Code	: E-68
Funding Agency	: NFDB
Duration	: February, 2011 – January, 2016
Project Personnel	: B. S. Giri (PI) and P. V. Rangacharyulu

P. hypophthalmus brooders used in the present study were procured from fish farmers. The brooders were 3 to 4 years old age and ranged from 2 to 5 kg individual body weight, 1000 numbers measuring a biomass of 3.0 MT. Brood fish were stocked in breeder ponds at a density of 3000 kg/ha. Seasonal variations of sexual activity were followed up on broodstock of equilibrated sex ratio of 1:1. *P. hypophthalmus* females were treated at different period of the year with PG extract/ Ovaprim during December, 2014 and March, 2015 for inducement of oocyte maturation and ovulation. The treated females were chosen after intraovarian biopsy on the basis of a diameter of their oocytes greater than 1.0 mm. Breeding of *P. hypophthalmus* was intimately related to monsoon season as they respond more during onset of monsoon months than later period. Female broodfish were treated with very low doses of PGE/Ovaprim during early monsoon season in order to stimulate ovulation and oogenesis. One third of the broodstock were used as effective breeders while rest others were considered as potential breeders. Ova were collected by dry stripping. The sperm was collected by stripping the males simultaneously directly on the eggs and were mixed gently with feather in order to enable fertilization with a male to female ratio of 0.3:1. Hatching of fertilized eggs was completed after an incubation period of 20 to 28 h depending on temperature. Rate of fertilization of eggs ranged from 80 to 90% as against 60 to 70% of hatching percentage depending on environmental conditions. A healthy male could yield 30 to 40 ml of milt which reduced to 5 ml during late monsoon months. Females yielded 1.5 lakh eggs/kg BW during monsoon seasons. In case of females, although there was no reduction in quantum of eggs during late monsoon season, the rate of fertilization was 0-5% at the end of breeding season.

Hatchlings to fry, and fry to fingerling rearing of the striped catfish were found to be most crucial part in the life cycle of *Pangasianodon hypophthalmus*. Hatchlings actively take supplementary feeds even before complete absorption of yolk sac. Hatchlings were fed with casein milk protein during the early stages till they are released into the rearing ponds. Hatchlings were provided with aeration continuously for 10 days till they develop accessory respiratory organs. Seed were gradually transformed to carbohydrate based diet after 10 days and further for a period of 15 days before they were administered formulated feeds from 25 to 30 days of hatching. Survival rates of 10 to 20% could be obtained from hatchling to fry stage.

Most of the Pangas farmers in Andhra Pradesh are small farmers whose culture ranges from 0.4 to 4 hectares. Hence, it is proposed to provide seed of *Pangassianodon hypophthalmus* to small fish farmers under outreach programme to demonstrate and inculcate the awareness of GMP in Krishna, West Godavari and Guntur Districts. This programme would be initiated from the current year. Before initiating such activities, there is strong need for building Brood bank at RRC, Vijayawada to meet future requirement of the brood stock after evaluating their genetic potentialities.

Project Title	: Risk and benefit assessment on an illegally introduced fish species Pacu (*Piaractus branchypomus*) in India
Project Code	: E-90
Funding Agency	: Collaborative with NBFGR
Duration	: April, 2014 – January, 2016
Project Personnel	: B. S. Giri (PI) and P. V. Rangacharyulu

There has been an increasing demand for alien fish species in India. *Piaractus branchypomus* commonly known as paku/roopchand is an the exotic species that is being cultured in Andhra Pradesh in an area of 1000 ha. However, its compatability with Indian major caprs in mixed/poly culture has not been fully understood. Hence, a survey is initiated in collaboration with ICAR-National Bureau of Fish Genetic Resources, Lucknow to study the impact of paku and its suitability in freshwater aquaculture in Andhra Pradesh. Roopchand is mostly cultivated in West Godavari and Krishna Districts in combination with rohu (*Labeo rohita*). Cost of production was high when roopchand was cultivated in monoculture system than when cultivated along with rohu at a stocking density of 7000 and 500 per hectare respectively. The fish was found to be highly sensitive to DO stress.

Project Title	: Development of low cost feeds for M. rosenbergii culture
Project Code	: I-90
Funding Agency	: Institute based
Duration	: April, 2014 – March, 2017
Project Personnel	: P. V. Rangacharyulu (PI) B. S. Giri and Ramesh Rathod

To reduce the cost of nursery rearing of *M. rosenbergii,* the costly protein ingredients were replaced with cheaper sources of protein in feeds and fed to PL of 0.05 g under pond culture conditions for 45 days. Cheaper protein source diet has resulted similar growth rate when compared to control diet. Grow out experiment is in progress to reduce the cost of feeding in prawn culture. Economics will be worked out and cost benefit will be calculated at the end of experiment

Table 36. Nursery rearing of *M. rosenbergii*

	Control diet	Exp. feed
Initial weight (g)	0.05	0.05
Final weight (g)	6.38	6.23
Weight gain (g)	6 .35	6.18

Table 37. Growout culture of *M. rosenbergii*

	Control diet	Exp. feed
Initial weight (g)	6.38	6.23
Final weight (g)	25.0	24.6

Table 38. Water quality parameters observed during the experiment

Parameters	Control pond	Experimental pond
pH	7.0	7.0
Temp.^{0}C	22.0	23.0
Transparency (cms)	20	15
DO (ppm)	4.86	5.06
Free CO_2 (ppm)	nil	NT
Alkalinity (ppm)	355	340
Total Hardness (ppm)	325	395
Calcium Hardness (ppm)	60.12	62.27
NH_3 (ppm)	1.0	1.0

Fish farmers with harvested jayanti rohu seed

Tribal fish Farmers of Dahod district of Gujarat sampling the fish during the demonstration of carp polyculture

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 2015
Project Personnel	:	C. K. Mishra (PI) and Subhas Sarkar

Demonstration programme at farmer's pond

On-farm demonstration on nursery rearing of genetically improved variety of rohu (Jayanti) spawn was undertaken in four fish farmers' ponds covering an area of 0.40 ha at village Devataj of Anand district and Village Pij of Kheda district of Gujarat. The spawn of average size of 5-6 mm were stocked @ 5 million/ha in the nursery ponds of each farmer's pond. After one month of nursery rearing, the growth and survival of the Jayanti rohu seed was found to be of 45-47 mm and 41% and 43-45 mm & 55% in the village ponds of Kheda and Anand district, respectively.

Demonstration programme on seed rearing of diversified species of fish was carried out in four numbers of fish farmers' ponds covering an area of 0.50 ha at village Devataj of Anand district and Village Pij of Kheda district of Gujarat. Fry of various fish species of major carps such as common carp, grass carp, catla, rohu, mrigal and minor carps such as *Labeo bata* and *Puntius gonionotus* were stocked in the earthen ponds of fish farmers @ 1.2 lakh/ha, which were prepared appropriately and were reared for two months with proper post stocking management measures including manuring, feeding etc. Whereas, fry of Asian magur, *Clarias batrachus* & post larvae of giant freshwater prawn *Macrobrachium rosenbergii* were stocked in hapa with 1m depth @ 100/m3 fixed in the same earthen ponds and were grown for two months in hapa with pieces of hollow plastic pipes (15 cm length and 10 cm diameter) as shelters, with pond plankton and supplementary feeding with rice bran and groundnut oil cake. Cleaning of hapas were made at every fortnight to remove algal deposits on net wall of hapas. The field data on growth and survival of various fish spp. were collected at periodic intervals. Soil and water quality parameters were monitored periodically. The weight gain percentage after rearing of the diversified seeds for two months in the four numbers of demonstrated farmers ponds were grass carp (86.4 - 104.8%), common carp (158.6-187.9 %), catla (83.3-96.8%), rohu (60.4-72.9%), mrigal (48.9-64.8%), *Labeo bata* (103-120%), *Puntius gonionotus* (107.6-126.1%), magur (94-111.9%), scampi (84.8-103%) and the survival percentage were grass carp (53-65%), common carp (49-58%), catla (53-61%), rohu (56-68%), mrigal (57-67%), *Labeo bata* (47-54%), *Puntius gonionotus* (50-57%), magur (68-78%), scampi (48-57%).

Five demonstration programmes on supplementary feed management for growth of carps were undertaken in the farmers' ponds covering an area of 9.9 ha located in the villages of Sojitra, Piplav, Jitodia, Vishnoli of Anand District and Mahudha of Kheda districts of Gujarat. The farmers under demonstration were provided with technical inputs of scientific information on supplementary feeding management along with key inputs of feed ingredients such as deoiled rice bran, groundnut oil cake, mustard oil cake, soybean oil cake and vitamin mineral mixtures. The demonstration programme is under progress.

Nursery rearing of Jayanti rohu at different stocking densities in Gujarat state

The objective of this study was to find out the optimum stocking density for nursery rearing of Jayanti rohu. The experiment was conducted at village ponds of Anand and Kheda districts of Gujarat during September-October, 2014. Hapas were fixed in two different ponds (about 0.04 ha each) in two different districts. Spawn to fry rearing experiment was carried out for a period of 30 days with different stocking densities such as 1.5, 3, 5, 9, 15 and 30 million/ha in duplicate. Growth of Jayanti rohu in terms of length and weight was maximum in hapas with the lowest stocking density of 1.5 million/ha at both the places. The survival rate varies from 48.5 to 20.0% and 50.5 to 34.35% at Kheda and Anand districts, respectively (Table 39). Soil and water quality parameters were measured periodically and remained in optimum range for normal fish growth. The experiment was concluded with the observation that up to 5 million/ha stocking density, the growth and survival of Jayanti rohu is satisfactory for practical purpose.

Table 39. Growth and survival of Jayanti Rohu in the hapa experiment at Anand and Kheda districts of Gujarat.

Stocking density (million/ha)	Initial length (mm)	Final length (mm)		Survival (%)	
		Kheda	Anand	Kheda	Anand
1.5	6.0	55.5	42.8	48.5	50.5
3.0	6.0	50.2	40.7	44.5	45.6
5.0	6.0	43.1	35.0	46.3	42.0
9.0	6.0	41.6	34.1	36.2	35.6
15.0	6.0	41.7	30.2	22.5	35.8
30.0	6.0	29.8	26.2	20.0	34.3

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

Sl. No.	Title	Venue	Duration	No. of Participants
1.	Freshwater carp culture, with emphasis on feed requirement and feeding procedure	RRC, Rahara	2-4 June, 2014	9
2.	*Mithajal Matsya Palan Me Unnati* (in Hindi) for the farmers of Punjab	CIFA, HQ	17-19 June, 2014	7
3.	Freshwater pearl culture for entrepreneurship development	CIFA, HQ	18-25 June, 2014	12
4.	Induced breeding of IMC and their culture technologies (Unemployed rural youths of Ramakrishna Samaj Sevak Sikshan Mandira, Belur math)	RRC, Rahara	7-12 July 2014	33
5.	Breeding techniques of SIFs and sewage fed aquaculture techniques	RRC, Rahara	21-25 July, 2014	4
6.	Carp breeding and Fish health management	Field Station, Kalyani	6-7 August 2014	37
7.	Genetics and molecular biology techniques and its application in aquaculture	CIFA, HQ	18-28 August 2014	23
8.	Breeding and seed production of murrel and anabas	CIFA, HQ	21-23 August, 2014	6

9.	Recent advances in freshwater aquaculture (for the Kerala State Fisheries Officers)	CIFA, HQ	25-28 August 2014	4
10.	Model training programme on Preventive health management in freshwater aquaculture	CIFA, HQ	3-10 September 2014	27
11.	International training on Basics in freshwater prawn culture and management (Govt. officers from Bhutan)	CIFA, HQ	15-29 September 2014	2
12.	*Aadhunik Mithajal Matsya Palan Taknique* (Modern Freshwater Aquaculture Techniques) for the farmers of Punjab	CIFA, HQ	25-29 November, 2014	10
13.	Training Programme for Tribal Youths of Assam	CIFA, HQ	02-05 December, 2014	60
14.	Induced breeding and seed production (one Fishery Official, Govt. Kerala and 6 Tribal fishermen from Karapuzha, Wayanad Dist, Kerala)	RRC, Bengaluru	8-10 December, 2014	07
15.	Freshwater pearl farming for entrepreneurship development	CIFA, HQ	12-19 January, 2015	10
16.	Hands-on training on Next Generation Sequencing and Data Analysis	CIFA, HQ	20-24 January, 2015	10
17.	Hands-on training programme on PCR based diagnostics for fish diseases (under National Surveillance programme for aquatic animal diseases)	CIFA, HQ	9-17 February, 2015	15
18.	Freshwater and sewage fed aquaculture based on natural foods and formulated feeds for farmers in West Bengal	RRC, Rahara	16-20 February, 2015	15
19.	Seed production of carps and tilapia in rain-fed areas	CIFA, HQ	28 February - 2 March, 2015	27
20.	Ornamental fish breeding and culture	RRC, Gujarat	18-20 March, 2015	16
	Total			334

Field Days conducted by CIFA

A total of 38 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 included 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 engaged 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

Sl. No.	Date	Particulars	Participants		Total
			Male	Female	
1.	26.04.2014	Students from Vidyasagar University, Pachim Medinapore, West Bengal	11	12	23
2.	20.06.2014	College of Fishery Science, S.V. Veterinary University, Muthukur, Nellore, A.P.	17	07	24
3.	23.06.2014	Sasya Shyamala KVK, RK Mission, Vivekananda Univ. Arapanch, Sonarpur, 24 Prgs, Kolkata	21	00	21
4.	07.07.2014	Students of Digvijaya Nath Snatokattar Mahavidyalay, Gorakhapur	18	30	48
5.	09.07.2014	Students of Fishery Research Centre, Imphal, Govt. of Manipur.	17	14	31
6.	16.07.2014	Students of MBA(RM), KSRM, KIIT University, Bhubaneswar	24	12	36
7.	19.07.2014	Students of Advance Diploma in Biotechnology, Kendrapara Autonomous College,Kendrapara	09	13	22
8.	06.08.2014	Fish farmers from Chandabali Block, Bhadrak	17	00	17
9.	25.08.2014	Farmers under ATMA, Ranchi, Jharkhand	25	00	25
10.	01.09.2014	Fish farmers from Nadpur Krushak Sangha, Nadpur, Nuagoan, Mayurbhanj, Odisha	08	00	08
11.	22.09.2014	US-INDIA-AFRICA Triangular International Trainees of "New Dimension in Agricultural Extension Management" for Agricultural Practitioners from Kenya & Malawi	18	12	30
12.	26.09.2014	Fish farmers from (Rairakhol & Naktideul Block) PD Watershed, Burla, Sambalpur, Odisha	43	02	45
13.	09.10.2014	Fish farmers under KVK, Navsari Agricultural University, Navsari, Gujarat	06	06	12
14.	24.10.2014	Fish farmers from Sourth 24 Pgs. districts of West Bengal	04	00	4
15.	05.11.2014	BFSc. Students of G.B.Pant Univ. of Agriculture & Technology, PantNagar, Uttarakhand	11	09	20
16.	10.11.2014	Fish farmers from Murshidabad district of West Bengal	16	00	16
17.	27.11.2014	Fish farmers of Dondi, District Balod, Chhattishgarh	13	00	13

18.	29.11.2014	Fish farmers of Dhamtari District of Chhattishgarh	31	00	31
19.	14.12.2014	IV B.F.Sc. Students, KVAFS Univ., Bidar College of Fisheries, Mathsyanagar, Kankanady PO, Mangalore, Karnataka	31	08	39
20.	17.12.2014	Farmers from Madhya Pradesh	47	00	47
21.	12.01.2015	B.F.Sc. Students of College of Fisheries, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab	04	15	19
22.	12.01.2015	B.F.Sc. Students of College of Fisheries, Chhattisgarh Kamadhenu Vishwavidyalaya, Kawardha, Dist-Kabirdham, C.G.	20	07	27
23.	30.01.2015	B.F.Sc. Students of Fisheries College & Research Institute, Thoothukudi, Tamil Nadu	20	14	34
24.	03.02. 2015	Fish farmers from BAIF, Bakawand, Bastar, Chhhatishgarh	20	00	20
25.	06.02. 2015	Fish farmers from Janjgiri-Chapa District, Chhatishgarh	29	00	29
26.	09.02. 2015	Fishery Inspectors & Officers from Durg district of Chhatishgarh	19	00	19
27.	11.02. 2015	Fish farmers, Asst. Fishery Inspector, Balarampur, R.Ganj, Chhatishgarh	10	00	10
28.	11.02. 2015	Fish farmers, Asst. Fishery Inspector, Ambikapur, Chhatishgarh	13	00	13
29.	11.02. 2015	Fish farmers, Paschim Medinipur Krishi-O-Krishak Kalyan Kendra, At: Maguria, PO: Nankar Maguira, Dist: Paschim Medinipur	44	06	50
30.	13.02. 2015	Students from Khalikote(Auto) College, Berhampur, Ganjam	04	16	20
31.	02.03. 2015	Fish farmers of Srikakulam district of Andhra Pradesh	18	00	18
32.	11.03. 2015	Fish farmers from Surajpur, Chhatishgarh	10	00	10
33.	12.03. 2015	Tribal farmers of Burdwan District under KVK, ICAR-CRIJAF, Bud Bud, Burdwan	10	00	10
34.	16.03. 2015	Fish farmers from Barrkote, Deogarh, Odisha	12	13	25
35.	18.03. 2015	Farmers from Dhenkanal district of Odisha	23	02	25
36.	26.03. 2015	Tribal Fishermen's from Rajastan Tribal Area's Development Cooperative Federation Ltd. Udaipur (TADD, Govt. of Rajastan), Rajastan	12	08	20
37.	28.03. 2015	Fish farmers from Malkangiri (Watershed), Odisha	24	00	24
38.	31.03. 2015	Fish farmers from Mahasamud district of Chhatishgarh	16	00	16
		Total:	**695**	**206**	**901**

Exposure visits to CIFA

The social science section organised 51 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. Interactive sessions with farmer groups were also organized for addressing various queries.

Table 42. Details of the group visits organized

Sl. No.	Date	Particulars	Participants		
			Male	Female	Total
1	09.04.2014	Students from BJB College, Bhubaneswar	12	28	40
2	26.04. 2014	Students from Vidyasagar University, Paschim Medinpur	12	13	25
3	27.04. 2014	Integrated Watershed Management Programme, Lahunipara, Sundergarh, Odisha	50	17	67
4	05.03. 2014	Farmers of Anandapur Bolck, Keonjhar, Odisha	30	00	30
5	23.05.14	Farmers of Patana Block, Keonjhar, Odisha	30	00	30
6	24.05.14	Students from Mothrers' Public School, Bhubaneswar	10	00	10
7	03.06.14	Students from Mothrers' Public School, Bhubaneswar	06	02	08
8	12.06.14	RC of CTCRI, Bhubaneswar Farmers of Ghatagaon Block, Keonjhar, Odisha	30	00	30
9	18.06.14	Watershed Villages of Boudh, Harbhanga Block	22	39	61
10	20.06.14	Students from College of Fishery, Nellore	18	07	25
11	24.06.14	A. H. Siddique, FEO, Assam	25	00	25
12	15.08.14	KIIT International School, Bhubaneswar	04	02	06
13	27.08.14	Farmers from Soroda, Ganjam, Odisha	34	06	40
14	24.10.14	Farmers from South 24 Pgs. districts of West Bengal	04	00	4
15	15.11.14	Students of DAV Public School, Nayapalli, Bhubaneswar	156	98	254
16	17.11.14	Farmers under ATMA, Polasora, Ganjam	20	00	20
17	18.11.14	Farmers with Scientist, CRRI, Cuttack	21	05	26
18	25.11.14	Zoology Students from Maharshi College of Nature Law, Bhubaneswar	14	24	38
19	25.11.14	Students of Saraswati Sishu Vidyamandir, Bhubaneswar	73	94	167
20	17.12.14	Students of Practising UGUP School, Khordha	22	21	43
21	19.12.14	Students of Zoology, Rairangpur College, Rairangpur, Mayurbhanj	18	20	38
22	23.12.14	Students of Jayadev College, Bhubaneswar	18	21	39
23	23.12.14	Farmers from Nabarangpur under NGO/IWDS sponsored by Nabarangpur-CAT Programme	29	00	29
24	06.01.15	PD Watershed, Rayagada district	35	00	35
25	07.01.15	College of Fisheries, OUAT, Rangeilunda	18	24	42

26	09.01.15	Tata Steel Gopalpur Project-EDII, Bhubaneswar	19	0	19
27	12.01.15	College of Fisheries, Kabirdham, Chhatisgarh	20	7	27
28	12.01.15	B.F.Sc. Students of College of Fisheries, GADV & ASU, Punjab	04	15	19
29	20.01.15	B-Tech Students from Gandhi Institute for Technology, Bhubaneswar	142	29	171
30	21.01.15	Farmers from Bamara, Sambalpur, Odisha	22	00	22
31	23.01.15	Students from B.S.N.V.P.G. College, Lucknow, UP	7	17	24
32	28.01.15	Farmers of FTI, Balugaon	31	00	31
33	30.01.15	Farmers from Remuna, Balugaon, Odisha	17	00	17
34	07.02.15	Farmers, ATMA, Chhatrapur, Ganjam, Odisha	16	00	16
35	13.02.15	Students from Khalikote College, Ganjam	04	16	20
36	16.02.15	Students from Raja N.L. Women's College, Pachim Medinipur, WB	02	26	28
37	18.02.15	Farmers from Jharkhand Training Institute, Ranchi	32	00	32
38	21.02.15	Farmers from Bolangir, IWMP-V, Odisha	11	05	16
39	26.02.15	Farmers from North Garo Hills district of Meghalaya	10	00	10
40	26.02.15	Farmers from Durg district of Chhatisgarh	13	00	13
41	28.02.15	Farmers from K. Singhpur, Rayagada, Odisha	03	10	13
42	04.03.15	Farmers from Rayagada, Odisha	14	02	16
43	09.03.15	Farmers from Balikuda, Jagatsinghpur, Odisha	29	00	29
44	11.03.15	Farmers from, Jagatsinghpur, Odisha	25	00	25
45	16.03.15	Farmers from Sohagpur, Shahdol, M.P.	42	0	42
46	17.03.15	Farmers from RITE, Bolangir	54	30	84
47	17.03.15	Students from Dept. of Fisheries, Utkal Univ., Bhubaneswar	09	12	21
48	18.03.15	Fish farmers of Watershed Areas, Sundargarh, Odisha	26	04	30
49	20.03.15	Farmers from IFFDC Ltd. Bhubaneswar	23	0	23
50	24.03.15	Farmers from Sankarakhol GP, Kandhamal, Odisha	07	03	10
51	27.03.15	Farmers from Kamalanga, Dhenkanal, Odisha	44	00	44
		Total:	**1337**	**597**	**1934**

Exposure Visit Programme for Ramakrishna Mission - KVK Farmers

The Institute organized a 5-day exposure visit programme during 23-27 June, 2014 for a group of 21 promising adopted fish farmers of 'Sasya Shyamala'—Krishi Vigyan Kendra, under the aegis of Ramakrishna Mission Vivekananda University, located at Arapanch in Ramakrishna Mission Ashrama, Narendrapur, Kolkata. The entire young group of farmers averaging 30 years, educated from Standard VI to graduation level and with an average 6 years of experience in fish farming were from South 24 Parganas District of West Bengal. Most of them (77%) are operating their own ponds, little below 1 ha on an average. Dr P. Jayasankar, Director gave an overview of the array of the technologies available with the Institute and advised the farmers to choose those which are most suitable for them.

Dr. Swagat Ghosh, Subject Matter Specialist in fisheries of the KVK who lead the team informed that the exposure programme was funded by National Fisheries Development Board, Hyderabad and its objective was to enlighten and motivate them about new ideas and technologies in aquaculture and finding solutions to their queries through direct interactions with the experts. The group also visited Aquaculture Field School of CIFA developed with technical guidance of its scientists on a private fish farm at Sarakana village of Khordha district, to facilitate horizontal and cost-effective transfer of aquaculture technologies. The farmers got lot of inspiration from observation of the field school activities in breeding season and interaction with the trained aqua-entrepreneurs. They felt that they could now effectively utilize the knowledge and experience gained from such progressive farmers for their development.

Learning skills from the trained farmers at Aquaculture Field School of CIFA

Table 43. Field demonstrations by RRC, Rahara and Field Station, Kalyani

Sl No.	Training/ Exposure visit	Venue	Trainees from	During	Nos. of participants
1.	Integrated Farming System	Bali Natures Club, Bali Island, Sundarban	Birajnagar & Majherpara, Sunderban	23 -24 March, 2014	100
2	Integrated Fish cum duck	Bali Natures Club, Bali Island Sundarban	Satjelia & Samsarnagar, Sunderban	29 March, 2014	30
3	SIFS breeding and culture	CIFA, Kalyani	Department of Adult Education, Kalyani University	19th & 24th July, 2014	13
4	Breeding and culture of SIFS	CIFA, Kalyani	Dept. of Fisheries, Govt. of West Bengal FFRTC, Kulia, Kalyani Sunderban	21 -25th July, 2014	4
5	Fish breeding &culture, integrated farming	CIFA, Kalyani	Krishnanagar Govt. College	16 Aug, 2014	17

6	Integrated farming, and value addition of fishes through pickle preperation	CIFA, Kalyani	Sagar Island sent from Post Harvest Technology Division, BCKV, Kalyani	9 Sept, 2014	25
7	Integrated farming, and value addition of fishes through pickle preparation	CIFA, Kalyani	Sagar Island sent from Post Harvest Technology Division, BCKV, Kalyani	15 Sept, 2014	23
8	Aquaculture in Integrated Farming System	Kakdwip centre of BCKV	Kakdwip centre of BCKV, Dept. of AICRP	29.8.2014	40
9	Breeding of air breathing fishes	CIFA, Kalyani	Department of Fisheries, Govt. of Kerala	June, 2014	5
10	Economics of fish culture and integrated farming	CIFA, Kalyani	Kanchrapara English medium School	02 February, 2015	22
11	Integrated Fish-cum agri- horti culture	CIFA, Kalyani	B.S.c students from Kanchrapara College	10 February, 2014	30
12	Carp breeding and Fish health management	Bali Natures Club, Bali Island Sundarban	Adivasipara, Bali Island, Sunderban	6 -7 August, 2014	37
13	Freshwater Aquaculture	Buchang cluster, Kolasib, Mizoram	Buchang cluster	8 -11 December, 2014	10
14	Development of Climate resilient Aquaculture Strategies for Sagar and Basanti Blocks of Indian Sundarban	Bali Natures Club, Bali Island Sundarban	Adivasipara, Bali Island, Sunderban	6-7 March, 2015	35

Table 44. Exposure visit to RRC, Rahara

Event	Organization	Duration	No. of participants
Exposure visit on Aquaculture and Wastewater Aquaculture	B.K.C College, Bon Hooghly, Kolkata-700108	8.7.14	29
Exposure visit on Induced Breeding of carp	R.K.Mission Boys Home High School, Rahara	20.9.2014	64
Orientation programme of ARS scientists	CIFA, HQ	30.10.14 -1.11.14	4 scientists of CIFA
Wastewater Aquauclture	Fisheries College, Mangalore, Karnataka	16.12.2014	39
Sewage fed aquaculture	D.C.H. College, Dakshin Barasat, 24 Paragans (S)	6.2.15	40 students
Sewage fed aquaculture	Patulia grirl high school	12.2.15	109 students

Table 45. Dissemination of technology on integrated farming system (IFS)

Integrated Farming System (IFS) Technology		
State	**Area**	**No. of Farmers**
West Bengal	Adivasipara and Birajnagar, Bali Island, Sunderban, 24 Pgs.(South)	120
	Naihati and adjoining area, 24 Pgs.(North),	7
	Nadia	3
Assam	Baksa Dist., BTC	30

Farmers-scientist interface meet on diversified fish farming at RRC, Anand, Gujarat:

The Centre organized one day Farmers-Scientists Interface meeting at village Pij, Taluka Nadiad of Kheda District in Gujarat on 21st February, 2015. Dr. P. Jayasankar, Director, ICAR-CIFA, Bhubaneswar inaugurated the meeting. In his address, he emphasized the need of year round availability of quality seed for better fish production. He also explained the high growth potential of 'Jayanti Rohu' and opined that the species should be propagated through multiplier units in Gujarat. Inaugural function was followed by a technical session on various aspects of diversified fish farming. The interactive session also took a note on farmers' feedback and their requirement. More than fifty farmers, Scientists of the centre, line department officials and research scientists from Anand Agricultural University, Anand participated in this programme.

Activities of Krishi Vigyan Kendra (KVK), Khordha

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 2014-15, KVK has conducted OFTs, FLDs and trainings benefitting the fish farmers.

1.1 Technology Assessment

One of the key mandates of KVK, technology assessment through On Farm Trails (OFT) is to ensure that the technology is fully suited for different micro situations of the mandated district Khordha. In the reporting period, KVK had significantly contributed towards assessment of 17 technologies and providing feedback to research system and feeding to the mainstream extension.

Table 46. Technology Assessed and beneficiaries

Technology Assessed through OFT	No of Beneficiaries
17	133

Technologies assessed in 2014-15 were in aromatic rice var. Geetanjali, seasame var. Amrit, Application of banana special: a micro nutrient, intercropping of maize in capsicum, application of Panchagavya, Tissue culture banana, probiotics in goats, oral pellet vaccine against Rhaniket disease.

Some of the significant technologies assessed during the reporting period are presented below:

KVK successfully trails out an Indigenous Technical Knowledge (ITK)

Pointed Gourd, one of the potential crops in Khordha district where farmers never adopted intercropping to increase incomes. KVK identified an ITK on intercropping of pointed gourd with onion and tested in 10 farmer's field. Onion Var. N 53 was planted in one side of the pointed gourd crop ridges. The trial indicated that the total net return from this intercropping was Rs. 1, 03,090 compared to farmers practice without intercropping accounting to Rs. 88,494. The trial concluded that farmers can get an additional net income of Rs. 14,596 by intercropping onion in pointed gourd by spending Rs. 4,524. KVK is planning to feed this result to the extension mainstream in Odisha for possible demonstration at larger extent.

Classic OFT on CIFABROODTM involving the Inventor Scientist

KVK conducted a OFT on CIFABROOD™ a proven carp brood diet developed by CIFA involving the inventor Scientist in two hatcheries. The trial was conducted in two ponds (0.3 ha each) stocked with IMC (200 numbers each) during 15th February 2014. The feeding trial started on 25th February 2014 and fishes were fed @ 3% of body weight with CIFABROOD™ in experimental pond while farm made feed prepared by the farmer was provided in the control pond. It was observed that within 45 days all the fishes in the trial pond were matured and fishes in the control ponds were immature. The fertilization rate was observed to be more than 90% with a spawn recovery of 80%. The hatchery produced 15 crores of spawn, hatchery owners had a seed market during off season and spawn buyers had a survival rate of fry between 50-70% . Early bred spawn has grown up to a fingerling size by June 22nd 2014 which fetches a good price to the farmers.

KVK prepared Panchagavya for testing out as a growth promoter in Vegetables

KVK has been working on different Plant Growth Regulators (PGR) in vegetables and one of the recent identified was Panchagavya a formulation obtained from Tamilnadu Agricultural University, Coimbatore. Panchagavya, an organic product has the potential to play the role of promoting growth and providing immunity in plant system. Panchagavya consists of nine products viz. cow dung, cow urine, milk, curd, jaggery, ghee, banana, tender coconut, yeast and water. When suitably mixed and used it has signficant positive effects. KVK prepared Panchagavya and supplied to farmers cultivating vegetables and the response has been encouraging on its effects on increasing yield, decreasing in the incidence of fruit cracks and flower drops and enhancing keeping quality.

KVK Procures Micro nutrient Formulation of Banana Special from ICAR-Indian Institute of Horticulture Research, Bangalore

By understanding the importance of micro nutrient supplementation to banana in the district, KVK signed a MOU to produce a micro nutrient formulation "Banana Special". The micro nutrient formulation is a licensed product of IIHR, Bangalore. The Horticulture expert of KVK underwent training at IIHR and the product has been tested at the farmers' field. Benefits obtained by spraying Banana special are on increase in bunch weight and grade. A production unit of Banana special is expected to be established at KVK by 2015-16

1.2 Demonstration

Proven frontier technologies identified by KVK were demonstrated through Front Line Demonstration (FLD) and during 2014-15 there were technologies demonstrated. Details of frontline demonstration and beneficiaries are presented below:

Table 47. Technology demonstrated and beneficiaries

Technology demonstrated	No. of Beneficiaries
16	198

Some of the significant technologies demonstrated and results obtained are presented below:

Demonstration of Azolla as Supplementary daily ration in Crossbred Cows increases milk production

KVK demonstrated Azolla as supplementary daily ration in crossbred cows involving 10 animal growers. The technology was demonstrated with the problems identified viz., high cost of cattle concentrate, less milk yield and economic return from crossbred cows. The results indicated that there is 20% increase of milk yield i.e 175 litres/month without azolla and feeding with azolla 210 litres/month. The net return/cow/month with cows fed with azolla accounted to Rs. 1225 and Rs. 2100 without feeding azolla.

KVK introduces Capsicum in Khordha district

Farmers had a preconceived idea that capsicum will not grow in their soils and KVK provided capsicum with other vegetables seedlings as a flood assistance in 2011. Farmers with much reluctance accepted and today the crop is cultivated by 550 farmers. During the reporting period, the demonstration on Capsicum var. Indra has recorded an average yield of 334.7q/ha with a net return of Rs. 5,78,348/ha in open field condition compared to farmers practice of cultivating green chilles which accounts to only Rs. 2,38,251/ha. Due to this intervention by KVK, the capsicum is preferred by the farmers and is gaining momentum as an alternate to green chilles in the district.

The other technologies demonstrated in 2014-15 were Hybrid paddy var. Ajay, Ground nut var. Durga, Pointed gourd var. Swarna Aluakik, Integrated Nutrient Management in Cucurbits, Capsicum var. Indra, Watermelon var. N5200, backyard poultry with improved layer, Duck strains vi z., Khaki Campbell and White Pekin, Black Bangal x Ganjam goats, Composite fish culture in community ponds, Poly culture and CIFAX

1.3 Trainings

During the reporting period,KVK organised 42 trainings benefitting 970 farmers/farm women on topics related to agriculture and allied sectors. About 67 rural youths were trained by KVK on topics identified towards initiating agriculture and allied enterprises as self employment avenues. Towards updating extension workers on latest technologies four trainings were conducted benefitting 65 grass root level workers in the district. Apart from the mandatory trainings of KVK, the 20 sponsored trainings were organised benefitting 495 farmers/farm women and extension workers. The sponsored programmes organised by KVK were supported by Odisha Watershed Development Mission; ATMA, Orissa Community Tank Management Project; Tata Steel Rural Development Society and many other government and non-government agencies. The trainings organised by KVK are presented below:

Table 48. Trainings organised by KVK

S.No.	Training	Category	No. of programmes	No. of Beneficiaries
1.	Mandatory trainings of KVK (off campus)	Farmers/farm women	42	970
2.	Mandatory trainings of KVK (on campus)	Rural youth	7	67
3.	Mandatory trainings of KVK (on campus)	Extension functionaries	4	65
4.	Sponsored trainings	Farmers and Extension functionaries	20	495
	Total		**73**	**1597**

3. Extension and Other Activities of KVK

3.1 Farmer Scientist Interaction

During the reporting period KVK organised three Farmer-Scientist interaction sponsored by ATMA-Khordha on capsicum cultivation, extension approaches for integrated farming system. The interaction benefitted 150 beneficiaries.

3.2 All Odisha KVKs assembled at KVK-Khordha

KVK conducted the Action Plan meeting of all Odisha KVKs at KVK-Khordha, CIFA. All the 33 KVKs of Odisha participated in the aciton plan meeting of 2014-15. Dr. P. Jayasankar, Director, CIFA; Dr. Anumpam Mishra, Zonal Project Director (ZPD); Dr. S. S. Nanda, Dean, Extension Edcuaiton, OUAT; Dr. S. R. K. Singh, Sr. Scientist and Dr. Prem Chand, Zonal Project Directorate attended the meeting. Deliberations were held on the presentations made by the Programme Coordinators of the state on OFTs, FLDs and trainings.

3.3 Third Consecutive Fishery Technology Workshop held at KVK

KVK has organised three consecutive Review cum Action Plan Workshops on Fishery Technology, jointly with Zonal Project Directorate, Zone VII, ICAR, Jabalpur and Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar during 2012, 2013 and 2014. The objectives of the workshop were towards reviewing the mandatory works of KVKs working on fisheries from Odisha, Chhattisgarh and Madhya Pradesh especially the OFT, FLD and trainings conducted by the participant KVKs during the period 2013-14. In addition to that the proposed OFT, FLD and trainings for 2012, 2013, 2014 were also reviewed by the experts from CIFA. The workshops also dedicated to deliberate on the achievements and action plan and one day for exposure visit to the works of KVK-Khordha and Puri on fisheries development interventions.

3.4 KVK organises Capacity Building of Extension Experts of KVKs from Zone VII

A capacity building programme titled "Capacity Building of Extension Experts on Methodological Initiatives for Accelerating Technology Application by KVK" was organised jointly by ICAR-Zonal Project Directorate, Zone VII, ICAR, Jabalpur and KVK-Khordha under ICAR-CIFA, Bhubaneswar, Odisha from November 22-25, 2014 at CIFA Auditorium. Programme Coordinators and Subject Matter Specialists of KVKs specialised in Agricultural Extension under Zone VII from the states of Odisha, Chhattisgarh and Madhya Pradesh attended the programme. The programme was inaugurated by Dr (Mrs) Neelam Grewal, Director, ICAR- Directorate of Women in Agriculture with the presidential address delivered by Dr. P. Jayasankar, Director, ICAR-CIFA. The methodological issues in technological applications were discussed for incorporating extension education in OFTs of KVKs. Special address on issues and prospects of Extension in KVK was delivered by Dr. S. Prabhukumar, ZPD, Zone I.

3.5 Initiatives on Late monsoon

The KVK in late 2014 worked on late monsoon issues through media towards helping farmers to have coping mechanisms towards land and water management issues. The KVK collaborated with Community Radio Station Radio Kissan in providing information and knowledge to farmers on late monsoon. The KVK also prepared a contingency plan for Khordha district and implemented the plan.

3.6 National Day for Women in Agriculture

The National Day for Women in Agriculture was organized by KVK ICAR- CIFA on 5th December, 2014 with the aim to empower women to defeat hunger and to emphasize on the role of women in agricultural development. The programme was sponsored by the Tribal Sub Plan programme of ICAR- CIFA. Dr. P. Jayasankar, Director, ICAR-CIFA, Kausalyaganga highlighted the role of ICAR-CIFA in last 25 years for socio-economic development and empowerment of women particularly for the tribal women. More than 200 tribal farm women from Tangi, Begunia and Bhubaneswar Blocks had participated in the programme. Smt. Surama Padhi, Ex-Minister, Government of Odisha inaugurated the tribal women farmers meet in the sideline of the National Day for Women in Agriculture in presence of Mr. Krishna Mohan, IFS, Director of Fisheries, Govt. of Odisha and Mr. A. P. Das, DGM, NABARD, Bhubaneswar.

3.7 Exhibitions

During the reporting period, KVK has represented in regional and state level exhibitions to demonstrate latest technologies and convergence activities for agriculture development in the district. KVK was twice awarded best stall prizes along with ATMA-Khordha and FM Radio Kissan in the regional level and state level exhibitions held at Balasore and Bhubaneswar, respectively.

3.8 KVK added new crops in "Crop Cafeteria" in campus

During the reporting period KVK has developed a crop cafeteria to demonstrate different crop varieties. Maize, Ginger, papaya, bottle gourd, capsicum, seedling production in vegetables are the main focus of 2014-15 crop cafeteria.

SPECIAL DAY CELEBRATIONS

National Fish Farmers' Day

The 14th National Fish Farmers' Day was observed at the Institute on 10 July, 2014. The day is commemorated in remembrance of scientists Dr K H Alikunhi and Dr. H.L. Chaudhury who had invented induced breeding technology on this day way back in 1957. Addressing the gathering, Director, ICAR-CIFA Dr. P. Jayasankar said the invention is hailed as a landmark achievement in the history of fishery in India and abroad. During the last 2 decades of devoted research, CIFA has contributed significantly toward development for breeding and culture of economically important fish and shellfish, use of plastics in aquaculture like FRP portable hatchery, feeds for different life stages of fish, disease diagnostics kits, improved rohu Jayanti, CIFABROODTM, Hybridization detection kit and other useful technologies for the farmers.

Speaking on the occasion, Agriculture, Fishery and ARD Minister Srijukta Pradeep Maharathy, the Chief Guest of the programme, highlighted the initiatives of the Government in implementing the new farmer polices. The minister also urged for the work upon the aquaculture diversification, fish genomics, proteomics and nanotechnology, water budgeting, ecosystem health and bioremediation, supply of good quality cheap fish and prawn feed to the farmers. He emphasized on Water budgeting since water will be an indispensable commodity for aquaculture in future. The promising technology which CIFA has produced must be used by the local farming community to enhance fish production and productivity. Partnership must grow among the stake holders to give a best environment for the farming communities.

Sri Binshnupada Sethi, Commissioner-cum-Secretary, Fishery & ARD, Govt. of Odisha was the Guest of Honour on this occasion. Around 100 fish farmers from Odisha, West Bengal, Manipur and Bodoland Territorial Area District (BTAD) of Assam were present in the event. Seven fish farmers from different parts of India were felicitated at the function. The awardees also shared their experience in fish farming with the scientists.

A scientist-farmer interaction session was also organized on the day aiming at providing solution to the problems faced by the farmers in pisciculture.

The RRC of ICAR-CIFA, Anand and KVK, AAU, Devataj, Gujarat jointly observed National Fish Farmers' day on 10 July, 2014 at Veterinary College campus, AAU, Anand, Gujarat. Dr. K.B. Kathiria, Ex-Vice-chancellor of AAU was the chief guest of the programme. As a part of this celebration, a farmers-scientist interface meet was also organized. A total of 60 fish farmers attended in the programme. Two extension leaflets in vernacular language were released on the occasion. Five progressive fish farmers from Anand and Kheda districts of Gujarat were felicitated for adopting scientific fish farming and also extending support to other fish farmers in the locality. Among others who graced the event were Shri. G.C. Vakani, Dy. Director of Fisheries, Govt. of Gujarat; Dr. P.P. Patel, Director of Ext. Edn., AAU; Dr. A.Y. Desai, Principal & Dean, College of Fisheries, Veraval; Dr. C.K. Misra, Scientist In-Charge, RRC of CIFA, Gujarat and Dr. G.G. Patel, PC, KVK, Devataj, Anand, Gujarat.

ICAR Foundation Day

ICAR Foundation Day was celebrated at the Institute on 16 July, 2014. A technical session on "Entrepreneurship Development in Freshwater aquaculture" was organized on the occasion in which there were representatives from RBI, NABARD, SBI, APICOL, OUAT, EDI, the senior level managers from Godrej Agrovet Limited and fisheries private sectors. Students from various fisheries colleges also attended the technical session. Prof. K. Pradhan, Chancellor, SOA University and Former Vice-Chancellor, OUAT, Bhubaneswar was the Chief Guest on the occasion.

International Day of Rural Women

Under the project on "Mainstreaming Gender Concerns in Freshwater Aquaculture Development – An Action Research", ICAR-CIFA organized the International Day of Rural Women on 15 October, 2014 in which 60 rural women attended the meeting. During the meeting Dr P. Jayasankar, Director, ICAR- CIFA emphasized on recognizing the contributions made by them in different ways for food and nutritional security of the nation. He also advised for enhancing fish production through different ICAR-CIFA technologies available to them. The scientists shared their experiences and encouraged them for utilizing their potentialities in fish production and opined that their indigenous technical knowledge should get more recognition. The participants also suggested that they should be more economically self-reliant and literate. The rural women expressed their grievances in getting the pond for lease in time and they face many problems at official level to get this work done. The Chief Guest of the function Mrs. Namrata Chadha, social activist said that the rural women should be aware of various schemes of the Government and to make proper utilization of the same. She also suggested them to follow different rules and guidelines in solving the social problems in day to day life.

National Day for Women in Agriculture

National Day for Women in Agriculture was

organized by Krishi Vigyan Kendra, Khordha, in collaboration with TSP, ICAR-CIFA on 5 December, 2014 with the aim to empower tribal women to defeat hunger and to emphasize on the role of women in agricultural development under TSP.

Dr P. Jayasankar, Director, ICAR-CIFA, highlighted the role of ICAR-CIFA in last 25 years for socio-economic development and empowerment of women particularly for the tribal women in different districts through aquaculture practices. Dr B.C. Mohapatra, Principal Scientist & Chairman, TSP mentioned about the role of ICAR-CIFA and KVK (Khordha) since their inception for dissemination of aquaculture technology to the tribal communities of India.

Smt. Surama Padhi, Ex-Minister, Government of Odisha inaugurated the tribal women farmers meet. Mr. Krishna Mohan, IFS, Director of Fisheries, Govt. of Odisha; Mr. A.P. Das, DGM, NABARD; Scientists; Technical Officers and other staffs of ICAR-CIFA and KVK (Khorda) were also present in the occasion. More than 200 tribal farm women from Tangi, Begunia and Bhubaneswar Blocks had participated in the programme.

International Womens Day

A workshop on 'Gender Sensitization' was held to celebrate International Womens Day on 9 March, 2015. The dignitaries presents on the occasion were Ms Snehanjali Mohanty, Member, Odisha State Commission for Women (OSCW); Ms Namrata Chada, Former Member OSCW and Ms Rajalaxmi Das, Member, Odisha State Commission for Protection of Child Rights.

Programmes undertaken by Hindi Cell

Hindi Chetna Maas was observed at the Institute during 15 September – 13 October, 2014. Debate, elocution and easy writing competitions were organized for the students and staff of the Institute. A workshop on 'Advances in Agriculture: Benefits and Challenges' was held in Hindi on 10 October, 2014. All the ICAR Institute located in Cuttack and Bhubaneswar participated in the workshop. The meeting was inaugurated by Dr H. S. Singh, Officer in Charge, CHES, Bhubaneswar.

Vigilance Awareness Week

Vigilance Awareness Week was observed during 27 October – 1 November, 2014. As part of the programme debate competition and lectures were organized in school and colleges. The valedictory function was held on 1 November, 2014 in which Sri Soumyendra Kumar Priyadarsi, IPS, IG of Police (Operations), Govt. of Odisha delivered a lecture on Vigilance Awareness. Dr. S. K. Swain, Prinicipal Scientist and Vigilance officer coordinated the programme.

OTHER EXTENSION ACTIVITIES

SUCCESS STORIES

Application of CIFABROOD™ - Farmer successfully conducted early and repeat breeding of Java punti *(Puntius gonionotus)* in 2014 at Kuliagarh, Naihati in 24 Paragnans-North district of West Bengal

Mr Tapan Patra son of Late Mr Bijoy Kumar Patra aged about 46 years is a well known and established breeder (Durga Enterprise) in Kuliagarh, Naihati area in N-24 PGS district of West Bengal. With his 15 years of experience, he generally conducts breeding of rohu, catla, mrigal (IMCs), silver carp, grass carp, common carp (exotic carps), as well as pangas, bata and to some extent on Java punti. His farm consists of 19 numbers of hatching pools and 7 nos of ponds of total 7.2 ha water area. He used to feed the broodstock with his own formulated feed. However, early breeding was never a easy job and being at Naihati he knows about the stiff competition among the hatchery owners. Commercialization of CIFABROOD™ brought the awareness among fish breeder community and the farmer fed fish brooders in a particular pond of 2.5 bighas @ 2% body weight starting from 7 February 2014. Initially the pond was stocked with the three




IMC species (The pond has total body mass of 850 kg of IMC and 400 numbers of Java punti (total body mass of 200 kg). At the end of 35-37 days, females of IMCs were matured and ready for breeding while very few males of respective species were oozing. He was completely disappointed not being able to utilize the early matured females with so much gonadal development not seen earlier in his pond. On the other hand, while netting in the same pond by chance it came to his notice that both male and females of Java punti were matured and ready for breeding. First breeding program with Java punti was started on 21st March 2014, which went on for next three months and could able to produce about 12 billion puntius spawn during March to May 2014. The demand for Java punti seed was more prominent in Naihati area due to nearby fish seed market in the locality also, and the rate in the season was Rs 400/- for each cup (125 ml containing ~1.2 lakh of spawn). Subsequently he removed all the IMC broods to another pond keeping only Java punti in it and continued feeding with CIFABROOD™. The spent fishes were maturing again and again with a time gap of about 7-10 days and described it as his maiden experience in his life. While in control pond Java punti matured later (20 days) with poor ovarian development and spent fishes were very weak as compared to experimental pond. Although his observation of rematuration of Java punti requires scientific analysis and confirmation, this has not only built his confidence in puntius breeding, but also, showed an alternative source of income in fish breeding business. This success has invited him to talk on Puntius breeding and seed production.

Farmer bred same catla brood twice during May to August 2014 under On-farm trial on CIFABROOD™ in KVK-Khordha

KVK-Khordha conducted On-Farm Testing (OFT) trial on CIFABROOD™ in two hatcheries of Khordha district. It supplied CIFABROODTM to the hatchery owners' viz., Mr Batakrushna Sahoo, Balianta Block and Mr. Kumar Jagat Ballav Maharatha, Banapur Block, respectively. In case of Mr. Sahoo, the trial was conducted in two ponds (0.3 ha each) stocked with IMC (200 numbers each). The feeding trial started on 25th February 2014 and fishes were fed @ 3% of body weight with CIFABROODTM in experimental pond while farm made feed prepared by the farmer was provided in the control pond. It was observed that within 45 days all the fishes in the trial pond were matured, but fishes in the control ponds were immature. The first breeding was undertaken with Catla on 10th May 2014 under a temperature regime of 42-440C. The fertilization rate was observed to be more than 90% with a spawn recovery of 80%. Early spawning and excellent survival rate of spawn has helped Mr. Sahoo to mark a place of himself in the seed market and to supply during off season. Mr. Sahoo has produced 16 crores of spawn in this season. In turn the spawn buyers had a survival rate of fry between 50-70%. In addition to that the early bred spawn has grown up to fingerling size by 22nd June 2014 which fetches a good price to the farmers. Mr Sahoo continued to feed these spent fishes with CIFABROOD™ and the fishes matured again in end of July 2014 which he bred on 3rd August 2014 particularly for catla. An average spawn recovery of 2.52 lakh/kg body weight of female was observed. Further, this trial has reconfirmed CIFABROOD™ as a proven carp brood diet.

On farm testing of KVK-Bhadrak

KVK Bhadrak tested 'CIFABROOD™' brood-stock diet to increase breeding performance efficiency of catla. Problem incurred was low income from carp hatchery due to very poor response of catla to induced breeding i.e. the breeding success rate of catla is below 40%. OFT on CIFABROOD™ was conducted in two numbers of hatcheries of Bhadrak district namely: - Radhakrushna Pvt. Carp Hatchery, Tentei (Hatchery-1) and OPDC Fish Seed Hatchery Project, Saramanga (Hatchery-2). The 100 Kg brood stock of catla with equal number of

males and females were stocked in 0.2 ha ponds on 28.05.14 in Pvt. Farm and on 29.05.14 in Govt. Farm. Feeding started on 1.6.14 in Pvt. Farm and on 16.6.14 in Govt. Farm and was fed @ 2% of bwt initially for five days followed by @3% of bwt for next 30 days. Females were rapidly matured but very few males were oozing. Breeding operation started on 29.06.14 and continued until 06.07.14 in Pvt. Farm (4 sets) while it was carried out during 14.07.14 to 20.07.14 in Govt. Farm (4 sets). Breeding response of females was observed in between 75-100 %(avg.87%) in Pvt. and 66-90 %(avg.77%) in Govt. Farm, respectively. Fecundity, fertilization rate and hatching rate varies between 1.2-2.0 lakhs/kg bwt., 80-98% and 86-100% in both the farms(Fig)

On-farm demonstrations on nursery raising of genetically improved variety of rohu at RRC, Gujarat

First time ever in Gujarat state, two numbers of on-farm demonstrations on nursery raising of genetically improved variety of rohu (Jayanti rohu) spawn was undertaken at village Devataj of Anand District and Village Pij of Kheda District of Gujarat. Two progressive fish farmers of these two districts were provided with complete technical support of nursery raising of the improved variety of Rohu seed i.e., Jayanti rohu (spawn) which was procured from ICAR- CIFA, Bhubaneswar. After pre-stocking preparation of nursery ponds, the Jayanti rohu spawn of average size of 5-6 mm were stocked @ 5 million spawn/ha in the nursery ponds of each farmer. The Jayanti rohu spawn were reared for one month from September to October, 2014 with appropriate post-stocking management practices including manuring, fertilization and supplementary feeding. After one month of nursery rearing, the growth and survival of the Jayanti rohu seed was found to be of 45-47 mm & 41% and 43-45 mm & 55% in the village ponds of Kheda District and Anand District, respectively. The demonstration revealed better growth and survival of Jayanti rohu seed compared to the performance of the local rohu seed as shared by the experience of local farmers.

WORKSHOPS

Workshop on Development of Strategies for Quality Seed Production in Eastern India and Awareness programme on CIFABROOD™

The Institute in collaboration with NFDB, Hyderabad is working towards stock improvement and quality seed production across the country. In this effort, West Bengal holds the prime position for being the largest supplier of fish seed in the country. Workshop on Development of Strategies for Quality Seed Production in Eastern India and Awareness Programme on CIFABROOD™ was conducted at ICAR-CIFA, Kalyani Field Centre during 28-29 November, 2014. It was conducted to sensitize the hatchery owner, farmers, planner and other stake holders on the importance of quality seed to increase the production. The stakeholders were exposed to various technological and institutional options available for maintaining quality seed in future.

There were more than 110 participants including hatchery owners, representatives from Research Institutes and entrepreneurs from Assam and West Bengal (Naihati, Kakdwip, Mursidabad). The Officer-in-Charge, Regional Research Centre, Rahara of ICAR-CIFA welcomed the participants. The scientists from ICAR-CIFA Headquarters also attended the programme and interacted with the participants. Dr Aninda Ghosh, Deputy Director, Govt. of West Bengal mentioned about the steps and initiatives taken by Govt. of West Bengal on quality seed production and application of CIFABROOD™ in the brood stock management. Dr B.K. Mondal, General Manager (Technical), WBSFDC, Govt. of West Bengal while addressing the gathering as Chief Guest expressed his concern on the quality seed production and steps taken by SFDC to procure and distribute quality seed in West Bengal. He emphasized the role of NFDB in shaping the quality seed production in India. Mr. Sankar Baruaha, Amalgameted Limited (TATA enterpriser) gave an account of his practical experience on use of different quality of carp seed. He has intimated the house that his organization has taken "Jayanti rohu" to Assam and got 60% higher growth than normal rohu.

Dr Bipul Das, Dean, Faculty of Fishery Science stressed upon human resource requirement for quality seed production and dissemination of technology across West Bengal. The entrepreneurs and farmers and seed grower raised many issues in relation to quality seed production. The following major recommendations were drawn by all stakeholders:

- Stopping of mix spawning in same breeding pool and reduction of inbreeding depression of hatchery stocks.
- Government support for developing brood stock facilities at farm level in scientific line
- Inclusion of genetically improved variety of carps for quality seed production
- Standardization of weight and measures (uniform size of seed sale container) to stop malpractices in seed market
- Vigorous implementation of existing guidelines of government of Indian in the newly accredited hatchery of West Bengal
- Breeding calendar and management practices of broodstock development with application of CIFABROOD™

WOMEN EMPOWERMENT

Empowering women through skill development in post-harvest value addition of freshwater fish

In traditional fisheries women are not usually directly involved in fishing activities, either because going for fishing in natural water bodies entails long hours of stay-away from home and family, or because of social taboos, customs and beliefs which prohibit them from netting in fish ponds and tanks. Women are thus confined to support activities such as fish handling, processing, marketing, etc. The scope and magnitude of women's participation in aquaculture production can be influenced to a large extent by the level of aquaculture technology according to the status of women in that society. The day has come when women are the key to food security for their households as well as to their society. Fish contributes to the food security and nutrition of both producers and consumers. In addition to its consumption in fresh, fish can be processed into a wide array of products such as frozen, dried and salted, pickled, fried, minced, or in ready to eat forms. In view of this ICAR- CIFA could seed an idea of empowering women in commercial aquaculture with modern technologies to generate enough revenue to sustain their families and save the society from fish scarcity. Hence under the "Mainstreaming Gender Concerns in Freshwater Aquaculture Development: An Action Research" project of CIFA a Training Programme was arranged on "Post-harvest Technologies of Freshwater Fish" for two days i.e., 18-19 July, 2014 for the rural women from three different villages of Puri and Khurda districts of Odisha. Dr. P. Jayasankar, Director CIFA and PI of the Project emphasized on the overall development of women folk through freshwater fish culture and suggested that the SHGs should adopt this activity as a business to enhance their economic status. During the programme they were trained in processing, preservation, post-harvest value addition and packing of freshwater food fish. It was a hands on training for them to prepare different fish products like pickle, fish fillet, fish papad, etc. with the help of technologies developed by the CIFA. Members of the women SHGs showed keen interest to take up this technology and improve their income generation and livelihood.

Aqua Field School (AFS) launched at Durg, Chhattisgarh

ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar has launched Y.S. Memorial Aqua Field School at Tirga, Durg, Chattishgarh during 8-9 October, 2014. The school was inaugurated by Hon'ble Member of Parliament and Former Central Minister Sri Ramesh Bais in the presence of Dr U. K. Mishra (Vice Chancellor, Chhattisgarh Kamdhenu University, Durg), Dr P. Jayasankar (Director, ICAR-CIFA), Dr H. K. Vardia (Dean College of Fisheries, Kawadah) and other guests. Other dignitaries of the inauguration programme were Sri Basant Tarak (Chairman, Fishermen Welfare Board, Chhattisgarh) and Sri Bijaya Baghel (Ex State Minister). About 80 farmers, 12 scientists and

faculties of college and 15 press representatives were present in the programme. Technology demonstration programme on farm made feed, processed fish products, fish waste management and other technologies were show-cased to the dignitaries, scientists, entrepreneurs and farmers. Dr P. Jayasankar, Director, ICAR-CIFA told that the AFS was inspired by the need for developing poor and backward class farmers and more efforts will be taken to popularize this innovative extension model.

A "Scientist-Farmer Interaction Session" was organized. The session was attended by Dr. B.B. Sahu, Dr S.C. Rath, Mr N.K. Barik, Dushyant Kumar Damle, Jitender Jakhar, Dr. Honnananda BR, Kamalesh Panda and Pabitra Barik. A large number of the farmers participated in the programme. Most of the queries of the farmers were related to fish seed production, feeding and disease management. The major discussion was on the disease management. The programme was coordinated by Mr N.K. Barik, Scientist and PI, BPD, CIFA. On the occasion, a demonstration programme on the culture of monsex tilapia was started in the farm of the Sri Surendra Belchanda. Sri Belchandan is an entrepreneur associated with BPD, ICAR-CIFA and has been instrumental in the establishment of the AFS in his farm. During the two days programme, a training programme was organized to impact technical knowhow to the advanced farmers, faculties of fisheries colleges and official of the state government. The concluding session was attended by Smt. Ramshila Sahu, Hon'ble Minister of Women and Child Development, Chhattisgarh.

INTERNATIONAL COLLABORATION

Extension functionaries from Kenya and Malawi visit ICAR-CIFA

Under the new Agriculture Partnership by India and US, "Evergreen Revolution", to address global food security, 30 extension workers, 14 from Kenya and 16 from Malawi, visited ICAR-CIFA on 22 September, 2014 to learn about the innovations in aquaculture and extension approaches. Under this partnership, these extension functionaries are undergoing a training programme at the National Institute of Agricultural Extension Management (MANAGE), Hyderabad on the title of "New Dimensions in Agricultural Extension Management" and a day of visit was paid to ICAR-CIFA by the participants. Dr. P. Jayasankar, Director, ICAR-CIFA welcomed the delegation and briefed them about Institute's objectives, growth and achievements. The visitors spent more than 4 hours witnessing the innovations of ICAR-CIFA in its freshwater aquaculture labs, farm and Krishi Vigyan Kendra. They were overwhelmed by observing the farm facilities and the contribution of ICAR-CIFA to the sector that are expected to lead a second blue revolution in the country. The participants also had an interaction with the Director and Scientists of the Institute. Dr. V.P. Sharma, Director (ITD&P), MANAGE accompanied the 30-members group which included 12 women participants. The delegation was overwhelmed by the hospitality and personal touch rendered by the Institute. The programme was coordinated by Dr. B.R.Pillai, Head, Aquaculture Production and Environment Division & Dr. G.S.Saha Head, Social Science Section of ICAR-CIFA. Possibility for future collaboration and linkage between the nations in freshwater aquaculture technology development and extension was explored.

International Consultation Meeting on Fish Genomics

The Institute organized an International Consultation Meeting on Fish Genomics on 23rd January, 2015 to discuss current status of fish genomics research and applications in India and abroad with a focus on developing a roadmap for future fish genomic research in India. The International Consultation was led by the Dr. Z. John Liu, Professor, Auburn University, AL, USA.

Dr. P. Jayasankar, Director, ICAR-CIFA and Convener of the meeting welcomed the participants and made a presentation on "Genetic Improvement: Journey for Black Box Approaches to Genomics" where he highlighted the need of genomics in traditional breeding and achievement of ICAR-CIFA under genomics work. He urged for future Indo-US collaboration in the fish genomic area for genetic improvement programme. Subsequently, the chief guest of the consultation Dr Z. John Liu, explained the breakthrough of whole genome sequencing and annotation in catfish. He emphasized the need of genomics in aquaculture for mitigating global problem of food and climate change.

Dr. T. Mohapatra, Director, ICAR-CRRI, Cuttack, explained about plant genomics and breakthrough in the rice genomic field and achievements. He emphasized on the need of research pertaining to functional analysis of genes/allele mining and driven research from genomics to phenomics is need of the hour. Scientists from ICAR-IASRI, ICAR-NBFGR,ICAR-DCFR,ICAR-CIFA and many other experts also spoke on the occasion.

The consultation meet raised many issues related to developing a roadmap for application of genomics in genetic improvement programmes. Marker assisted breeding, whole genome sequencing, phenomics, development of phenotypic and ontology databases and genomic selection in aquaculture were identified as the critical areas in which ICAR and other organizations like Auburn University, USA should have collaborative and network programmes. The program was coordinated by Dr S. Nandi and Dr J. K. Sundaray of Fish Genetics & Biotechnology Division,ICAR-CIFA.

Third Pilot Session on "Five keys to Safer Aquaculture Products to Protect Public Health"

The Institute in collaboration with World Health Organization (WHO) organized the Third Pilot Session of 'Five Keys to Safer Aquaculture Products to Protect Public Health' during 2-4 February 2015. WHO has developed 'Five Keys to Safer Aquaculture Products to Protect Public Health' to help the small scale aquaculture producers raise safe and nutritious fish for themselves, their families and for sale in local market. The program was aimed at developing awareness about hygiene, food borne diseases, safe handling of fish to ensure sustainability of safe and nutritious locally grown food produced by small and marginal aquaculture farmers.

Dr. P. Jayasankar, Director, ICAR-CIFA, India conveyed the importance of the workshop for sustainable aquaculture and consumer's safety, which was designed to help the small scale aquaculture producers raise safe and nutritious fish for themselves, their families and for sale in local market. Shri Bishnupada Sethi, IAS, Commissioner-cum-Secretary, Fisheries & ARD Department, Govt. of Odisha inaugurated workshop and suggested to look into the issue of certificates to farms who abide by safe practices for raising fish and giving incentives to good quality fish producing farmers. Dr. I. Karunasagar, International Consultant on Food Safety Working for FAO, WHO and other International Organisations, Ms. Francoise Fontannaz, Technical Officer of WHO of the United Nations and Dr Margaret Miller, Senior Researcher in the University of Maryland, and Dr. P. Krishnamohan, Director, Fisheries also attended the function. The participants of the workshop on the first day included Assistant Fishery Officers representing different districts of the State, NGOs working with fish farmers, representatives from Export Inspection Council, OUAT and other ICAR Institutes. Dr. B. R. Pillai, Head , APED, ICAR-CIFA coordinated the programme.

Some of the noticeable recommendations emerged out of the 3- day programme include:

- A slogan on "Keep Yourself Clean and Make your Pond Clean".
- The workshop topic could be included in the course curriculum of the primary school students as well as intermediate level.
- Models on pond cleanliness and safe aquaculture products may be displayed in public gathering, exhibition, Kishan Mela etc.
- Private and Public Media such as Newspaper, Periodicals, Radio & Television Visual Aids,

Postal Department Articles (Meghdoot postcards, Inland letters, Envelope & Postage Stamps, etc.) may carry and spread the message of pond cleanliness and safe aquaculture products.

C.V.Raman International Fellowship

Dr. Daniel Adjei-Boateng from Ghana, recipient of C.V.Raman International Fellowship for African Researchers carried out two months research on "Development of Hatchery Protocol for Freshwater Prawn" under the guidance of Dr. B.R. Pillai, during 15 July to 15 September, 2014.

Outreach Activities

Three outreach activities have been initiated by the ICAR during the XIth the 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, and 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.

Outreach Activity on Fish Feeds

A training-cum-demonstration programme on "Farm Made Feeds in Aquaculture" under Outreach Activity on Fish Feeds (A Network Project of ICAR, New Delhi) was organised at Vivekanada Atmabikash Kendra, Barjora, Bankura on 7 August, 2014 with over 200 participants. The programme was inaugurated by Swamiji Rangalal Maharaj. Scientists from the Fish Nutrition and Physiology Division and Regional Research Centre of ICAR-CIFA, Rahara/Kalyani coordinated the programme. Mr. Abhijit Banerjee, ADF, Bankura and Mr. Amit Gayen, Joint B.D.O participated in the programme. The programme was aimed to create awareness and disseminate technology to the local fish farmers on preparation and use of farm made fish feed for their own fish crop. An exhibition on different commercial feed types, conventional and non-conventional feed ingredients was organised. Preparation of pelleted farm feed was also demonstrated to the fish farmers. The programme was followed by a Farmers-Scientists Interface Meeting in which farmers clarified their doubts on the subject.

Know Your Farmers (KYF) Programme

Know Your Farmers (KYF) is a novel programme initiated by ICAR-CIFA, Bhubaneswar. The mandate of the programme is to know the farmer's problems in the different regions and to formulate research projects based on their problems. The states of West Bengal, Jharkhand, Assam and Tripura were visited for the said purpose by a team of eight young scientists in groups during the quarter.

States Visited	Duration	Status and recommendations
Jharkhand	14 – 16 January, 2015	The fish culture is mainly done in community based ponds, those are not properly constructed and the feeding practices are totally lacking. It was felt that, a number of technological interventions and training programmes are to be conducted for the farmers on fish culture to increase fish production.
West Bengal	13 -16 January, 2015	The aquaculture practices are well developed. A number of ITKs are being used in farm field and farmers are well educated and informed about the recent developments in aquaculture sector. They are much interested to learn the innovative technologies.
Tripura	22 - 26 February, 2015	The state has a huge demand (>95% of population is fish eaters) for freshwater fishes like Pabda, Chitala including Indian major and minor carps; and freshwater prawn. The state is in need of well-developed packages of breeding and culture practices for Pabda and Chitala.
Assam	22 – 26 February, 2015	The state has huge potential for aquaculture development. At present, most of the fish farmers are following traditional way of aquaculture. Training to the farmers on fish breeding and culture is needed to increase the fish production.

Farmers-Scientists Interaction Meet in West Bengal

A Farmers-Scientists Interaction Meet with the farmers of West Bengal was organised at Field Station of ICAR-CIFA, Kalyani on 16 January 2015. Major issues raised by the farmers in the meet were:

1. Different variety of small fishes like *Puntius sarana, Mystus gulio, Cirrhinus reba* have to be addressed for breeding and culture like *Ompok pabda* in the regional centre for the farmers.
2. Demonstration and training on cryopreservation of milt.
3. Brood-stock management including pond soil preparation has to be circulated in Bengali language.
4. Integrated farming system with demanded fishes and its economic contribution to be worked out for different regions.

Dissemination program

Under dissemination program, till date 278.75 lakhs spawn of improved rohu produced and disseminated to different States like Assam, Bihar, Odisha and West Bengal. For further dissemination in form of fry and fingerlings, 19 lakhs improved rohu spawn stocked at CIFA farm.

Krishi Parivartan Yatra

Mr. N. K. Barik, Scientist(SS) was the National Coordinator of the ICAR-NAIP Krishi Parivartan Yatra which covered the states of Andhra Pradesh, Maharashtra, Madhya Pradesh, Uttar Pradesh and Delhi during 11-19 May, 2014 to show case the technologies developed by NAIP projects.

Radio talks/Television programmes

- Dr. S.C. Rath, Senior Scientist delivered 3 talks on farm made feed on AIR (25.7.2014, 25.3.2015 and 27.1.2015) and one DDK programmes on farm made fish feed on 29.8.2014. He also delivered on a talk on Farm-made fish feed on All India Radio Cuttack on 31.7.2014 and participated in Rural Programme Subject Committee meeting of All India Radio at Cuttack on 20.8.2014. Further, he participated in the phone-in programme of Doordarshan Kendra,Bhubaneswar on 26.8.2014.
- Dr S. K. Swain, Principal Scientist delivered a Radio Talk on "Ornamental Fish Farming through SHG" in KrishiSansar programme in Bhubaneswar on 12.09.2014. He also devivered a Radio talk in Odia on "Swayang Sahayak Gosthidwara Rangeen Machha Palan –O- Bikribata" in Krishi Sansar programme in Bhubaneswar on 5.2.2015.

Video films

The following Video films were made by the Institute

- Documentary film on "Ornamental Fish Village" in English (10 min)
- "Mainstreaming Gender Concerns In Freshwater Aquaculture Development."
- "Fusion of Freshwater Aquaculture and Product Value Addition Skill for Mainstreaming Women in Livelihood Generation."

Commercialization/Transfer of Institute's Products

New Products

The products developed by this Institute viz., Fish

Planktofert & CIFA-Fish Biofert were displayed at the 86th Annual General Meeting (AGM) of ICAR on 18 February, 2015 at National Agricultural Science Complex, New Delhi. On the occasion, Shri Radha Mohan Singhji, Hon'ble Union minister for Agriculture and Hon'ble State ministers for Agriculture, Hon'ble Members of Parliament and delegates visited the technology display and appreciated the products.

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 2014-15, 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 2014-2015.

Training programmes

The Institute organised demonstration-cum-hands-on training programme on "Magur Breeding and Seed Production Techniques" at Muhuripur magur hatchery, Tripura during 24 to 26 July, 2014,in which 11 Tripura State Fisheries Department Officials and 7 Fish Farmers participated. All the trainees were given hands-on training on hormonal injection to female fish, testis collection, sperm suspension preparation, stripping of female, egg incubation, etc.

Another training programme on "Aquaculture Development in Mizoram" at Buchang cluster, Kolasib District, Mizoram was organised during 8-12 December, 2014. The scientists from the Institute also visited Lengpui Fish Farm to discuss the modalities of setting up an ornamental fish unit. Further, they also visited State Fisheries Directorate, Aizwal and organized an awareness programme on ornamental fish farming for livelihood development. The participants included State Fisheries Officials, entrepreneurs, farmers and traders.

Farmer-Scientist Interaction Meet in Assam

A Farmer-Scientist Interaction Meet with the farmers of Bodo Territorial Council, Assam and State Government Officials of Assam was organised at Guwahati on 23 February 2015. The theme area of the meet was "Installation and Operation of FRP Hatcheries in Assam". All the participants thanked ICAR-CIFA for providing two useful gadgets like FRP carp and magur hatcheries to the state of Assam and both are performing very well in the state. Total 74 farmers and state officials participated in the meet. The recommendations from the interaction training with farmers and state government officials were as follows:

- Demonstration and training on breeding of *C. batracus, O. pabda* & carp in FRP hatcheries, at least in one progressive farmer's field.
- Dissemination of pabda, magur, koi and singhi breeding and culture technologies to farmers.
- Demonstration of composite fish farming in BTC.
- Exposure trip of Assam State Fishery Officers to ICAR-CIFA, Bhubanesawar and West Bengal for increasing their technical expertise.

Farmer-Scientist Interaction Meet in Tripura

A Farmer-Scientist Interaction Meet was organised on 25 February, 2015 at , Agartala, Tripura. There were 83 farmers and state government officials as participants in the meet. The theme area of the meet was on "Installation and Operation of FRP Hatcheries in Tripura". Hon'ble Fisheries Minister of Tripura, Shri Khagendra Jamatia was the Chief Guest of the function. In the meeting, Hon'ble Minister expressed his satisfaction for the ICAR-CIFA developed FRP hatcheries and also for other technological interventions like; installation of tubifex culture unit, practical training of pabda breeding and rearing with reduction of cannibalism

in early stages, Jayanti rohu demonstration, etc. Now Tripura State Govt. is purchasing the FRP carp hatcheries from ICAR-CIFA and providing to its farmers. Following recommendations emerged from the meet:

- Demonstration of semi-intensive carp culture in different districts to increase fish production of the state.
- Portable hatchery of pabda for the Tripura State.
- Training on pabda and magur rearing and culture.
- Developing technical expertise through training and exposure trips for fishery officials to ICAR-CIFA, Bhubaneswar and West Bengal.
- Demonstration of CAFABROOD™ in the state.

Other Activities

- Two tubifex culture units were set up at Melagarh and Lembuchera State Fish farm, Tripura for larval feeding of pabda. A long term demand from Tripura State was accomplished.
- Integrated pig cum fish culture demonstration at BTC, Assam were conducted for nine months at five beneficiaries ponds of Kokrajhar, Baksa and Udalguri districts. Fish production of 3.63 MT/ha/yr from benchmark production of 0.9-1.0 MT/ ha/yr were recorded. Pig attained weight of 71- 80 kg in nine months.
- A training programme was organised during 8-9 December, 2014 at Buchang cluster, Kolasib, Mizoram during which Mr. S. P. Singh Deputy Director of Fisheries, Mr. Thonga, DFO, Kolasib and S K. A. Majumdar, Engineer Dept of Fisheries, Govt. of Mizoram were present. The training, which included composite fish culture, pond preparation, pre and post-stocking nutrient management, magur culture, ornamental fish culture and economics of profitability and marketing of freshwater fishes, its culture was conducted with all proposed beneficiaries of CFC demonstration pond owners and other aquaculture farmers. The farmers were selected by DFO, Kolasib.
- The team visited the Mizofa Fish Seed Farm, Chempai valley to see the feasibility of Magur FRP breeding units facilities like nursery, brooders pond and supplying seeds over a period of years to state Govt. and other fish seed farm of the state.
- A meeting was held with Dr. S. B. Singh, Joint Director of ICAR Research complex, Kolasib and Deputy Director and DFO, Kolasib to discuss financial modalities for implementation of CIFA aquaculture activities at Kolasib.
- An awareness programme on ornamental fish farming on livelihood development of Mizoram was organised at Department of Agriculture Conference Hall with 25 participants which included State Fisheries Officials, private entrepreneurs, farmers and traders.
- The team visited Aquarium Centre, Fish Planet, Khatla, Aizawl along with Director and Joint Director Mizoram to provide advisory services to a trader cum farmer, Mr Sangha. He was given advice on controlling diseases and winter care for ornamental fishes and advised to stock ornamental fish in his unit during late February and March for a period of 7 months culture.
- On invitation, Dr S.K.Swain,ICAR-CIFA and Mr M.A Razi, Director, Mizoram met Minister Residence to discuss about the programme we have conducted at Mizoram. Further he conveyed his thanks to CIFA and the Scientists for showing interest in NE Region and especially for Mizoram. He was showing his keen interest to develop integrated fish farming, composite fish farming and development of ornamental fish village in some tropical valley of Mizoram. He had shown his interest to send few officials, entrepreneurs to CIFA and request for conducting training programme on skill development in aquaculture through NFDB. During his discussion, he showed his interest to visit CIFA during the training programme.

Tribal Sub -Plan, Kalyani Field Station

First ever Success in production of carp seed using FRP Hatchery at Bali Island, Sunderban:

After a series of trials of induced breeding of Indian Major & Minor Carp *(Labeo rohita* and *Labeo bata)* using FRP hatchery and hapa were undertaken at the Bali Island, Sundarban. From 3 sets of rohu (female 3 Nos. weighing 3.3 kg) and 12 sets of bata (female 12 nos. weighing 2.5 kg), a total number of 5 lakh eggs were produced, out of which 4 lakh spawns were successfully raised during August, 2014. Hatchery was operated with the pond water after decrease in salinity.

During August, 2014, Dr. P.K. Sahoo visited all the demonstration sites of Bali Island for inspection and monitoring the fish health. Dr. Sahoo collected samples of fish blood, kidney, liver, gill from the stocked fish of different beneficiary's pond at Adivasipara, Bali Island, Sunderban for examining the presence of any pathogen. After proper examination of the collected samples it was found that all the fishes in the demonstration ponds are free from diseases

Livelihood Development through Carp Polyculture Integrated with Agri-Horticulture & Livestock at different islands of Sunderban – linkages with other Institutions:

CIFA – PDFSR, Merrut – BCKVV, W. B.: A demonstration programme on integrated farming has been initiated among 120 families at Adivasipara and Birajnagar, Bali Island, Sunderban, West Bengal in collaboration with Project Directorate of Farming System Research (ICAR), Bidhan Chandra Krishi Viswavidyalaya. Dr. B. Gangwar, former Director, PDFSR; Dr. Mahadev Pramanik, Former Depuy Director of Research, BCKV; Dr. Manabendra Roy, Assistant Professor, BCKV were actively involved in this programme.

CIFA – Dept. of Forest, W.B.: Interventions of CIFA has created an alternative livelihood for poor people of Bali Island which resulted a remarkable reduction of poaching to nearby reserve area and drastic reduction of casualties in recent months. Dept. of Forest, Govt. of West Bengal also sent a team to Adibasipara, Bali Island, Sunderban to interact with the villagers about the success of the project. Being fully satisfied, the Forest Dept., W.B. requested CIFA to replicate the same model at other Islands. They also informed that operational cost of the said programme will be borne by their Department. Accordingly, CIFA Kalyani has intervened another Island i.e. Satjelia Island, where Composite Fish Culture demonstration has been initiated in 12 ponds, integrated with duck. Ducklings were provided during the month of April, 2014 after proper training. Dr. A. Mankar, DDF, Sundarban Tiger Reserve along with representatives of IUCN and Dr. P. P. Chakrabarti visited Satjelia Island for assessing the fish growth. Sampling results of fish showed very promising growth in all the 12 ponds including ducks.

On request from the Dept. of Forest, Govt. of West Bengal, fishes (IMC) were also stocked to the beneficiaries pond at Gosaba, Pakhiralay and Sajnekhali islands of Sundarban covering 0.75 ha waterbody @ 10,000 nos./ha. during August, 2014.

CIFA – West Bengal University of Animal & Fishery Sciences: Dr. P. Biswas, V.C., Registrar, Director of Research, Dean (Fisheries) and Senior Professors visited CIFA activity sites at Bali, one training programme was arranged during 6 – 9th in collaboration with CIFA, Kalyani. Dr. P. P. Chakrabarti visited some brooders pond at Adivasipara, Bali Island, Sundarban during 6-7 March, 2015 and found that feed to be supplied to the brood fishes for proper gonadal maturity of the fishes with an aim for successful breeding and seed production during the coming monsoon. He also observed that some poly lining ponds to be developed for rainwater harvesting. This water will be used for running the hatchery with an aim to maximize the hatching percentage.

CIFA, Kalyani – NBSS & LUP, Salt Lake – CSSRI, Canning: Considering the soil acidity spreading in different layers of Bali Island, identified through a soil resource mapping by NBSS & LUP, three Regional Stations have initiated land shaping programme for enhancing productivity of fish and agri – horti crops to improve livelihood in Bali Island of Sundarbans. In this programme seed of IMC have been stocked @ 8,000 nos/ha in 10 beneficiaries' ponds covering 0.234 ha area.

Establishment of new Regional Research Centre

Survey visit of ICAR-CIFA team to Bathinda, Punjab

Assistant Director General (I.Fy), ICAR, Director and a team of Scientists, ICAR-CIFA visited some villages in Bathinda District, Punjab on 11 and 21 August, 2014 for surveying the feasibility of setting up a new Regional Research Centre of Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar with the objective to further strengthen and expand fishery activity in the state of Punjab. All the aspects of fish production in the area were studied and meetings were held with private fish farmers and the officers of the Fisheries Department of Punjab. Based on these facts, a detailed report which included the advantages, limitations and infrastructure required to develop a freshwater aquaculture demonstration farm was submitted to the ICAR.

The Director, Department of Fisheries, coordinated the survey programme and was assisted by the Deputy Commissioner, Assistant Director-Fisheries, and The Chief Executive Officer, F.F.D.A., Bathinda district, Govt. of Punjab.

EDUCATION AND INFORMATION SYSTEM

Library

Dr. Hiraral Chaudhuri Library of ICAR-CIFA is well-stocked with a good collection of books and journals on Fisheries and Aquaculture. It has around 7028 books/ monographs, 2900 back volume journals and other reference materials. The library has more than 200 members viz., Scientists, Technical Officers and Research Scholars. The 4200 user visited the library for different purposes. This includes both inside users (Scientists, Technical Officers & Research Scholars of the institute) & 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 implementation of this Software, the necessary software and hardware was provided by the 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 library is providing Document Delivery Services to various Institutions (including the SAUs) under the NARS.

Dr. Hiraral Choudhury Library subscribed 22 International and 44 Indian Journals for the year 2014. Rs 21.88 lakhs was spent for subscription of foreign journals and Rs.76544 for Indian journals for the year 2014.

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 of the current developments, it also provides monthly 'Current Contents' service by compiling content pages of current journals received. It 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 photocopy facility, and during the year 2014-15 more than 36000 copies have been photocopied. Most of the photocopies were provided to the Scientists and technical staff of the Institute and they were done from the holdings of the library. Rs. 18,783 has been deposited to the Institute towards the photocopy charges.

The library also sends the news clippings about the fisheries and aquaculture sector and the media coverage of the events 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 2013-14 (in English & Hindi)
- CIFA News Vol. 21 (No. 2, 3, 4); Vol. 22 (No. 1)
- Research Project Proposals – 2014-15
- Training manuals for various training progammes
- Leaflets and Brochures

Communication of reports

- Material for DARE-ICAR Annual Report 2014-15
- 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
P. Singh A. Mukherjee G. C. Rana R. N. Mandal P. P. Chakrabarti and B. N. Paul	The 2nd Best Award Poster Presentation of the paper entitled 'Evaluation of Breweries Waste in the Feed of Catla catla Fingerlings	Global Animal Nutrition Conference	20-22 April, 2014
P.C. Das	Prof. H.P.C. Shetty Award for 2014 of Asian Fisheries Society, Indian Branch (AFSIB)	10th India Fisheries & Aquaculture Forum, NBFGR, Lucknow	12 November, 2014
P.K. Sahoo	Pillay Aquaculture Award-2014 by Pillay Aquaculture Foundation, Indian Chapter for Excellence in Aquaculture Research, Extension and Development	10th India Fisheries & Aquaculture Forum, NBFGR, Lucknow	12 November, 2014
B. Kar Cisse Mousa A. Mohapatra J. Mohanty P. Jayasankar and P. K. Sahoo	Best Poster Award (2014): Variation in susceptibility pattern of fish to *Argulus siamensis*: Does immune response of host play a role	10th Indian Fisheries and Aquaculture Forum, NBFGR, Lucknow	12-15 November, 2014
J. K. Sundaray	Dr V R P Sinha Medal (Ichthyology) from Zoological Society of India, Boodh Gaya	25th All India Congress of Zoology at Gurukula Kangri University, Haridwar	17 November, 2014
Subhas Sarkar	Best Oral Presentation Award	2nd International conference on Bio-resource and stress management, Hyderabad	7-10 January, 2015

Academic Accomplishments

Dr. L. Sahoo awarded Ph.D. degree in the subject of Animal Bredding and Genetics from Odisha Universty of Agricultural & Technology, Bhubaneswar during September 2014 with a thesis title of "Development of genomic resources in Indian major carp, *Labeo rohita*

Recognitions

Name	Recognition
P. Jayasankar	➢ Member, National Committee to oversee and regulate Introduction of Exotic Aquatic Species in Indian waters, DAH&D ➢ Member, Academic Council, ICAR-CIFE, Mumbai
P. K. Sahoo	➢ Member, Expert Committee of DBT Indo-Vietnam Joint Call Proposals 2014-15 ➢ Member, Task Force on Aquaculture & Marine Biotechnology of DBT, New Delhi for the period 2014-17 ➢ Chairman for the five year assessment committee of the functional group Employees of CIFE and attended the committee on 05.12.2014

CIFA Annual Day

The 28th Annual Day of CIFA was celebrated on 1 April, 2014. The Chief Guest on the occasion was Dr Ashwini Kumar Director, Directorate of Water Management, Bhubaneswar and the Guests of Honour were Dr Damodar Satapathy, Director, College of Fisheries, Rangailunda; Dr B. Ravindran, Director, Institute of Life Sciences, Bhubaneswar; and Dr (Mrs) Neelam Grewal, Director, DRWA, Bhubaneswar, who graced the occasion and distributed the Annual Awards (2013) of the institute to the winners. More than 300 participants including farmers and retired employees of CIFA attended the function.

Apart from other celebrations, the CIFA Annual Awards (for the year 2013) were presented to the following:

Best Division/ Section/ Unit/ Research Groups Business Planning and Development Unit	:	Fish Health Management Division and
Best Scientist	:	Dr. P.K. Sahoo, Principal Scientist & National Fellow
Best Technical Staff member	:	Shri P.R. Sahoo, T-6 (SMS, Fisheries), KVK, Khordha
Best Administrative Person	:	Shri Sudhansu Sekhar Mohapatra, AF&AO
Best Skilled Support Staff/Field Staff	:	Shri Bauribandhu Ghadei, SSS Shri Prafulla Kumar Naik, SSS
Award for Hindi work	:	Dr. B.C. Mohapatra, Pr. Scientist; Dr. P.K. Meher, Sr. Scientist; Dr. B.K. Das, Pr. Scientist; Dr. K.N. Mohanta, Pr. Scientist; Dr. D.K. Verma, Sr. Technical Officer and Dr. P. Jayasankar, Director
Best Extension worker	:	Dr. (Mrs.) U.L. Mohanty, Sr. Technical Officer
Best Research Scholar	:	Ms. Sofia Priyadarsani Das, Research Associate (FGBD) under the project 'Whole Genome Sequencing and Development of allied genomic resources in two commercially important fish. Labeo rohita and Clarias batrachus (DBT)'
Awards for School Children	:	No nominee
Best girl child award for the highest scorer in class X in 2013	:	Miss Saswati Mohapatra (D/o Shri S.S. Mohapatra, AF&AO)
Best boy child award for the highest scorer in class X in 2013	:	

Special Appreciation Awards-2013 were also given as follows:

Most Effective Institution Building Committee of the year "Farm & Campus Management Committee"	:	Dr J. K. Sundaray, HoD, FGBD and Team
Best Slogan of the year: "People and Partnership"	:	Dr P. N. Ananth, Programme Coordination (KVK) and Team
Most Significant Commercialized Technology of the Year: "CIFABROOD™"	:	Dr S. Nandi, Principal Scientist and Team
Most High Profile Extension Programme of the Year "Livelihood Development of Tribal Communities of Bali Island, Sunderban, West Bengal through Aquaculture"	:	Dr P. P. Chakraborty, Principal Scientist and Scientist in Charge, RRC Rahara and Team

Special Appreciation Awards-2013 were also given as follows:

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.

The recipients of the above awards are as follows:

Girish Chandra Chaudhury Memorial Scholarship

Name	Class	Amount (Rs)
	Graduation	3000.00
	Graduation	3000.00

Smt. S. Susheelamma Scholarship

Name	Class	Amount (Rs)
	IX-X	1800.00
	IX-X	1800.00
	VII-VIII	1200.00
	VII-VIII	1200.00

Dr T. Ramaprabhu Memorial Award

Name	Designation	Amount (Rs)
	SRF	3000.00
	SRF	3000.00

Dr B. R. Mohanty Memorial Award

Name	Designation	Amount (Rs)
	SRF	1400.00
	SRF	1400.00

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 6-7 April, 2015. The Chairman of the Committee was Dr. K. K. Vaas, 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. P. Jayasankar, Director, ICAR-CIFA and Dr. K. D. Mahapatra, Member-Secretary.

Institute Research Council

The mid-term Institute Research Council (IRC) meeting was held on 28 January, 2015. The annual IRC meeting was held during 8-10 April, 2015 with Dr P. Jayasankar, Director as Chairman and Dr B. K. Das, Member Secretary. Discussions were held on the on-going 14 institute based projects, 25 externally funded projects, 3 outreach projects, women scientist projects funded by DST and other research programmes.

Institute Management Committee

The 38th Institute Management Committee meeting was held on 30 January, 2015 under the Chairmanship of Dr P. Jayasankar, Director, ICAR-CIFA. It was attended by Dr. (Mrs.) Vindhya Mahindra, Principal Scientist, ICAR-National Bureau of Fish Genetic Resources, Lucknow; Dr. A. Barat, Principal Scientist, ICAR-Directorate of Cold Water Fisheries Research, Bhimtal, Uttarakhand; Sri N.V.R.N. Murty, F&AO, CIFA as Members; Sri J. R. Biswal, AO(I/C), CIFA as Member-Secretary; Dr Bindu R. Pillai, HoD, APED, CIFA; Dr J. K. Sundary, HoD, FGBD, CIFA; Dr S. S. Mishra, HoD, FHMD, CIFA; Dr S. S. Giri, HoD, FNPD, CIFA; Dr G. S. Saha, Incharge, Social Science Section, CIFA & Dr P. N. Ananth, PC, KVK, Khurda as Member-Invitees. Agenda items included confirmation of proceedings of 37th Institute Management Committee, discussions on highlights of research programmes of the Institute, procurement of equipment and execution of works in 2014-15 under plan budget and other items like inclusion of Hospitals for treatment of ICAR-CIFA family members; approval of master plan of ICAR-CIFA, etc.

HUMAN RESOURCE DEVELOPMENT

Foreign Assignments

Sl. No.	Events/Training	Venue	Period	Participant(s)
1.	Consultancy Service in the field of fish seed production and hatchery management	DEVTEC-Nepal Pvt. Ltd, Nepal	1-30 September, 2014	P. Routray
2.	CGIAR Challenge for Water and Food (CPWF) Conference on Revitalizing the Ganges Costal Zone	Dhaka, Bangladesh	17-23 October, 2014	J. K. Sundaray
3.	Regional Consultation on Strategy and Action Plan for Sustainable Intensification of Aquaculture in Asia Pacific	Bangkok, Thailand	27-28 November, 2014	P. Jayasankar
4.	FAO Workshop on Prioritization of Asia Regional Aquaculture Development and Management	Bangkok, Thailand	29 November, 2014	P. Jayasankar
5.	12th Technical Advisory Committee Meeting (TAC-12)	NACA, Bangkok, Thailand	10-12 March, 2015	P. Jayasankar

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

Sl. No.	Events/Training	Venue	Period	Participant(s)
1.	ICAR sponsored short course on "Participatory Research for Mainstreaming Gender Concern in Agriculture"	DRWA, Bhubaneswar	22-31 May, 2014	U. L. Mohanty
2.	Management Development Programme on Leadership Development	NAARM, Hyderabad	15-26 July, 2014	S.S. Mishra
3.	MDP training on PME	NAARM, Hyderabad	4-8 August, 2014	J. K. Sundaray

4.	Professional Attachment Training	Anand Agriculture University	10 May – 09 August, 2014	Kiran D. Rasal Uday Kumar Udit
5.	Freshwater Fish Taxonomy	Manipur University, Imphal, Manipur	22-26 September, 2014	S. Ferosekhan
6.	SAARC- Regional Training on Fish Processing Quality Control and HACCP" (organized by SAARC Agricultural Centre (SAC), Dhaka, Bangladsh)	CIFT, Cochin, Kerala	20-26 October 2014	B. B. Sahu
7.	Training on "Implementation of ICAR ERP Solution- Financial- Additional Training Thereof" by IBM	NIRJAFT	07-11 November, 2014	Arabinda Das Sukanta Sarkar
8.	Advanced Concepts and Techniques to Augment Reproduction in Livestock	National Institute of Animal Nutrition and Physiology (NIANP), Bengaluru	12 November – 2 December, 2014	S. Ferosekhan
9.	Professional Attachment Training	TNAU	13 November, 2014 – 14 February, 2015	I. Sivaraman
10.	Professional Attachment Training	CMFRI	15 November, 2014 – 13 February, 2015	Subas Kamble Mukesh Ku Bairwa
11.	Professional Attachment Training	ICAR-NDRI	17 November, 2014 – 19 February, 2015	Mohan R. Badhe
12.	Training on Aadhar Enabled Biometric Attendance System	National Informatics Centre, Bhubaneswar	29 November, 2014	S. Ferosekhan
13.	DST sponsored training on "Entrepreneurship Development & Management for Scientists and Technologies Working in Govt. Sector"	EDII, Ahmedabad, Gujarat	8-12 December, 2014	S.S. Mishra
14.	CAFT training on "Utilization of Degraded Water Resources through Pisciculture"	ICAR-CIFE, Mumbai	28 January – 17 February, 2015	Ajit Keshav Chaudhari
15.	CAFT training on "Advanced Tools for Analysis of Phenomic and Genomic Data"	ICAR-NDRI, Karnal	5-25 March, 2015	Kiran D. Rasal

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

Events	Venue	Duration	Participant(s)
Meeting with Chairman, QRT (CIFA) and DG, ICAR and submission of QRT Report	ICAR, New Delhi	5 April, 2014	P. Jayasankar
EFC meeting	ICAR, New Delhi	7 April, 2014	P. Jayasankar P K Sahoo
Global Conference on Animal Nutrition	Bengaluru	20-21 April, 2014	S. S. Giri N.Sridhar B N Paul B.Gangadhar
68th Foundation Day Celebration	CRRI, Cuttack	23 April, 2014	P. Swain
Workshop on "Livelihood Development of Tribal Farmers through Aquaculture"	Bali Island, Sunderban, West Bengal	23-24 April 2014	B. C. Mohapatra
Workshop on Nutritional Advantages of Shrimp with Focus on its Heart Healthy Lipid Elements	CIBA, Chennai	25 April 2014.	J. K. Sundaray
Interactive Conference of Directors of ICAR Institutes (convened by Secretary DARE and DG, ICAR)	NASC Campus, New Delhi	28 April, 2014	P. Jayasankar
Review cum Action Plan Workshop on Fishery Technology Evaluation	KVK, Khurda	29 April, 2014	K. D. Mahapatra
XXIVth Meeting of the Regional Committee No.VIII	CPCRI, Trivananthapuram	2-3 May, 2014	N. Sridhar
SMD Level Meeting of Outreach Programmes	New Delhi	9 May, 2014	S. S. Giri
Brainstorming workshop on 'Strategies for Enhancing Livestock and Fishery Production in the State of Chhattishgarh'	Anjora, Durg	13 May, 2014	P. Jayasankar
National Committee meeting on "Introduction of Exotic Species to be Introduced to Indian Water"	Krishi Bhavan, New Delhi	24 May, 2014.	J. K. Sundaray
Fourth Meeting of Scientific Panel for Fish and Fisheries Products	ICAR, New Delhi	26 May, 2014	P. Jayasankar
Interaction Meeting with the Members of Business Incubation Center (BIC), NIRJAFT, Kolkata	NIRJAFT, Kolkata	29 May 2014	P. Swain
Foundation Lecture of NAAS	NAAS, New Delhi	5 June, 2014	P. Jayasankar

NAIP-IFPRI Workshop on Impact of Capacity Building under NAIP Overseas Training	NASC Complex, New Delhi	6-7 June, 2014	P. Jayasankar P. K. Sahoo P. Swain S. K. Swain S. Adhikari B. C. Mohapatra S. Mohanty S. Nandi
State level seminar on "A New Avenues for Fisheries in Gujarat"	Commissionorate of Fisheries, Gandhinagar, Govt of Gujarat	07 June, 2014	C. K. Misra
Rural Programme Subject Committee Meeting of All India Radio	Cuttack	12 June, 2014	S. C. Rath
5th Asia and Pacific Fisheries Commission (APFIC) Regional Consultative Forum Meeting (RCFM), Food and Agriculture Organization of United Nation.	Hyderabad	19-21 June, 2014	N. K. Barik
Standing Advisory Committee (SAC) Meeting, ZTM-BPD Unit, NIRJAFT, Kolkata	BPD Hall, NIRJAFT, Kolkata	26 June, 2014	P. Swain
Meeting of XXII ICAR Regional Committee Zone-II	CIFRI, Barackpore	27-28 June, 2014	P. Jayasankar P. P. Chakrabarti
Regional Council Meeting-II	CIFRI, Barackpore	27 -28 June, 2014	P. P. Chakrabarti
4th Advisory Committee Meeting of Hilsa Project	CIFRI , Barrackpore	8-9 July, 2014	D.N.Chattopadhyay
Meeting with the Chairman, ACM including all CCPIs to discuss future plan and prepare for annual review meeting.	CIFRI , Barrackpore	10 July, 2014	D.N.Chattopadhyay
International Conference on Host-Pathogen Interaction	National Institute of Animal Biotechnology, Hyderabad	12 – 15 July, 2014	M. Samanta
Conference on Sunderban Tiger Reserve and Wildlife Protection Society of India under TSP	CIFRI, Barrackpore	21 July, 2014	B. N. Paul
49th Meeting of the Academic Council	CIFE, Mumbai	26 July, 2014	P. Jayasankar
ICAR Foundation Day and ICAR Directors Conference	ICAR, New Delhi	29-30, July 2014	P. Jayasankar
Brain Storming Session on "Insects related to Veterinary and Fisheries Sciences"	NBAII, Bengaluru	2 August, 2014	N.Sridhar Hemaprasanth

Meeting with Fisheries Officials for the Site Selection for Opening of RRC of CIFA in the State	Bhatinda, Punjab	10-12 August, 2014	P. Jayasankar S. K. Swain B. S. Giri
Scientific Advisory Committee of KVK	Puri and Nayagarh	2-13 August 2014	S.C. Rath (ICAR nominee)
Institute Management Committee Meeting of CIFRI, Barrackpore	CIFRI, Barrackpore	18 August, 2014	K. D. Mahapatra (As member)
Society for Technology Management (STEM) Annual Summit program	Hyderabad	19-20 August, 2014	P. Swain K. C. Das
Meeting of the Committee of Fishery Group under 'Inventory of Agricultural Technologies for West Bengal and Andaman & Nicobar Islands'	ZPD, Zone II, Kolkata	22 August, 2014	D.N.Chattopadhyay
Meeting on Preparation of Draft Perspective Plan and Finalization of Immediate and Long term Action Plans for Aquaculture development of West Bengal	CIFRI, Barrackpore	30 August, 2014	P. P. Chakrabarti
Seminar-cum-Workshop on "Sustainable Coastal Zone Protection through Mangrove Management in Odisha"	Council of Cultural Growth & Cultural Relations, Cuttack	6-7 September, 2014	B.C. Mohapatra N.K. Barik
Lecture and interaction with Dr Jose Graziano da Silva, Director General, FAO	NASC, New Delhi	8 September, 2014	P. Jayasankar
Visited Scigenom Labs Ltd	Cochin	1-10 September, 2014	L. Sahoo
Annual Meeting on Zonal Institute of Technology Management Committee (ZITMC), East zone	NIRJAFT, Kolkata	12 September, 2014	P. Swain
XXIII Meeting of ICAR Regional Committee (VI)	Anand Agricultural University, Anand	12-13 September, 2014	C. K. Misra
2nd Coordination Committee Meeting of Hilsa Project	Krishi Anusandhan Bhawan, Pusa, New Delhi	18 September, 2014	P. Jayasankar D.N.Chattopadhyay
Workshop on Fish Disease Surveillance	CIFRI Barrackpore	18 September, 2014	B.K. Das
Meeting on Food Safety and Standards Authority of India	ICAR, New Delhi	19 September, 2014	P. Jayasankar
ICAR-CIFE Academic Council meeting	ICAR, New Delhi	19 September, 2014	P. Jayasankar
Steering Committee Meeting on Tilapia	Ministry of Agriculture, Govt. of India	22 September, 2014	J. K. Sundaray

Launching Workshop under NSPAAD Project	Vijayawada	23 September, 2014	P. Jayasankar P. K. Sahoo B. K. Das
TSP training programme on "Popularizing the Feed Based Aquaculture in the Farmer's Field"	Betnoti Block, Mayurbhanj, Odisha	25 September, 2014	P. Jayasankar B.C. Mohapatra K.N. Mahanta K.C. Das N.K. Barik K. Murmu
TSP Programme for handing of Portable Carp Hatchery	Sulthan Bathery, Wyanad, Kerala	29 September, 2014	P. Jayasankar
National Workshop on Freshwater Fish Taxonomy	Manipur University	24 September - 1 October, 2014	Priyanka Nandanpawar
Brainstorming Session on Water in Agriculture	ICAR Research Complex for North East Hill Region, Barapani, Shilong	7-8 October, 2014	S. Adhikari
Launching Programme of the Aqua-Field School in the Tribal Area	Durg District, Raipur	8-9 October, 2014	P. Jayasankar S.C. Rath B.B. Sahu N.K. Barik
Brainstorming Session on 'Fisheries Extension to Boost Fish Production – The Way Forward'	Fisheries Research and Information Centre (I), KVAFSU Hebbal, Bangalore	13 October, 2014	B.Gangadhar N.Rajesh
Symposium on Indian Fisheries and Aquaculture: 25 Years of Achievements and Way Forward	CIFE, Mumbai	21-22 October, 2014	P. C. Das
3rd ICAR Institute-State Department Interface Meet	CRRI, Cuttack	21-22 October, 2014	B. R. Pillai U. L. Mohanty
16th Meeting of the 'National Committee on Introduction of Exotic Species in Indian waters'	Krishi Bhavan, New Delhi	27 October, 2014	B.R. Pillai
Workshop on OPEN ACCESS in Agriculture (organized by FAO-ICAR-NAARM)	NAARM, Hyderabad	29-30 October, 2014	J. K. Sundaray
Indo-Norwegian Cooperation – Joint Workshop on Aquaculture	Mumbai	30 October, 2014	P. Jayasankar
Meeting on State Agriculture Plan	Junagarh, Gujarat	5 November, 2014	C. K. Mishra
International Conference on Emerging Trends in Biotechnology	Jawaharlal Nehru University, New Delhi	6 – 9 November, 2014	M. Samanta
Seminar on "Brain Stroming Session for Biotechnology Solutions in Aquaculture"	Gujarat State Biotechnology Mission, Gujarat	11 November, 2014	P. Swain

Career Advancement Scheme meeting of scientist of CIFA	ASRB, ICAR, New Delhi	11-13 November, 2014	P. Jayasankar
10th Indian Fisheries & Aquaculture Forum	NBFGR, Lucknow	12-15, November, 2014	Director, 33 scientists & 9 Technical Officers
5th Global Symposium on Gender in Aquaculture and Fisheries	ICAR-NBFGR, Lucknow	13-15 November, 2014	Rajesh N.U. L. Mohanty D. P. Rath
Participated in Consultation on 'Blue Revolution'	ICAR, New Delhi	17 November, 2014	P. Jayasankar
Career Advancement Scheme Meeting of the Scientists of CIFA	ASRB, New Delhi	18 November, 2014	P. Jayasankar
Workshop on Biotechnology Solutions in Aquaculture (organized by Gujarat State Biotechnology Mission)	Gandhinagar, Gujarat	18 November, 2014	C.K. Mishra
Participated in Discussion and presentation on VISION 2050 document	SMD, KAV-II, New Delhi	19 November, 2014	P. Jayasankar
Mid-term review meeting of RFD Committee of Fisheries Division	ICAR, New Delhi	20 November, 2014	P. K. Sahoo
Coordination Committee Meeting of AICRP on APA	ICAR Research Complex for North Eastern Hilly Region, Barapani, Umiam, Meghalaya State	20-21 November, 2014	B. C. Mohapatra B. B. Sahu
International Conference on Frontier in Comparative Endocrinology and Neurobiology	University of Hyderabad	25-28 November, 2014	Uday Kumar
Seminar on Agriculture on the Occasion of Horticulture Expo	Utkal University, Bhubaneswar	30 November, 2014	N. K. Barik
Winter School on "Advanced Concepts and Techniques to Augment Reproduction in Livestock"	NIANP, Bengaluru	12 November - 2 December, 2014	S. Ferosekhan
Marine Ecosystems-Challenges and Opportunities-MECOS-2014, International Symposium	Kochi, Kerala	2-5 December, 2014	Rajesh N.
Career Advancement Scheme Meeting of the Scientists of CIFA	ASRB, New Delhi	11 December, 2014	P. Jayasankar
Participated in 'MDP on Leadership Development" : A pre RMP Programme	NAARM, Hyderabad	1-12 December, 2014	S. S. Giri
Entrepreneurship Development & Management for Scientists and Technologies Working in Govt. Sector"	Entrepreneurship Development Institute of India, Ahmedabad, Gujarat	8-12 December, 2014	S. S. Mishra

Fish Culture Programme	KVK, Balasore and Swami Vivekanand Seva Ashram, Bhadrak (Odisha)	17 December, 2014	P. Jayasankar
Special Meeting of the Advisory Committee on Hilsa Conservation and Research chaired by the Honourable MIC (fisheries), W.B.	CIFE centre, Kolkata	17 December, 2014	D.N.Chattopadhyay
India Tilapia Summit 2014	Rajiv Gandhi Centre for Aquaculture, MPEDA, Vijayawada	18 December, 2014	P. Routray
Fish Culture Programme	KVK, Kendrapara	19 December, 2014	P. Jayasankar
Workshop on "Orientation Programme on Aquarium Keeping and Maintenance for the Traders and Farmers of Hyderabad"	NFDB, Hyderabad	19-20 December, 2014	S. K. swain
83rd Annual Conference, SBC	KIIT University, Bhubaneswar	17 – 21 December, 2014	M. Samanta
Workshop on "Mahseer in India: Resources, Captive Breeding, Propagation, Policies and Issues"	Guwahati	22-23 December, 2014	C. Devraj Kiran D Rashal Uday Kumar Udit
Mahseer in India: Resource Captive Breeding, Propagation, Policies and Issue	College of veterinary Science, Khanapara, Guwahati, Assam	22-23 December, 2014	Kiran D. Rasal Uday Kumar Udit
National seminar on " Prospects of Microbiology in Modern Scenario"	Biju Patnaik Conference Hall, OUAT, Bhubaneswar	25 December, 2014	P. Swain
Brainstorming session on "Good Aquaculture Practice (GAP) Certification in India– Criteria and Implementation Plan"	NAAS, New Delhi	29-30 December, 2014	B.R. Pillai
102nd Indian Science Congress	Mumbai University, Mumbai	6 January, 2015	P. Jayasankar
Bengal Global Business Summit	Kolkata	7-8 January 2015	P.P. Chakrabarti
Interactive Meetings with Hon'ble Union Minister for Agriculture & Food Processing Sri Radha Mohan Singhji	ICAR-Zonal Project Directorate, Zone VIII, Bengaluru-24	9 January, 2015	N.Sridhar
The Second International Conference on Bio-resource and Stress Management	Hyderabad	07-10 January, 2015	Subhas Sarkar
Best Aquaculture Practices and Facilitation of Export of Fisheries products from Odisha	IMAGE, OUAT	22 January, 2015	S. Ferosekhan
Seminar on "Eco-responsive Feeding and Nutrition"	Assam Agriculture University, Guwahati	22-24 January, 2015	K.C. Das

InCoFIBS- 2015	National Institute of Technology, Rourkela	22 – 24 January, 2015	M. Samanta
National Conference on "Eco-responsive feeding and Nutrition" at 9th Biennial Animal Nutrition	Guwahati, Assam	22-24 January, 2015	K. C. Das
Annual Hindi Workshop	ICAR-DMAPR, Anand, Gujarat	28 January, 2015	Subhas Sarkar
9th Convocation of the WBUAFS	West Bengal University of Animal and Fishery Sciences, Nadia	29 January, 2015	P.P. Chakrabarti
68th Annual Conference of Indian Society of Agricultural Statistics (ISAS)	ICAR-IASRI, New Delhi	29-31 January, 2015	Nirupama Panda
Scientific advisory Committee Meeting of KVK, Devataj, Anand, Gujarat	Devataj, Anand, Gujarat	02 February, 2015	Subhas Sarkar
Meeting on Hilsa Project	CIFRI, Barrackpore	3 February, 2015	D.N.Chattopadhyay
12th Agricultural Science Congress	NDRI, Karnal	3-6 February, 2015	P. Jayasankar G. S. Saha B. C. Mohapatra Nitin K. Chandan D. K. Verma
Blue Paper Forum (conducted by the U.S.Soybean Export Council)	Bengaluru	5-6 February, 2015	N.Sridhar M. R. Raghunath Rajesh Kumar
Workshop on "India Aquaculture Pathfinder-Blue Paper Forum" scheduled	Bengaluru	5-6, February, 2015	N.Sridhar M.R.Raghunath Rajesh Kumar
Zonal Agricultural Research and Extension Council Meeting of Anand Agricultural University, Anand, Gujarat	AAU, Anand, Gujarat	10 February, 2015	C. K. Misra
Fourth Annual Review Meeting of the NFBSFARA/NASF for the Hilsa Project	New Delhi	10-12 February, 2015	D.N.Chattopadhyay
Annual Review Workshop of the NFBSFARA Project (BS-4003)	NASC Complex, Pusa, New Delhi	10 – 12 February, 2015	M. Samanta
Review of Activities at the Regional Centre and Visit to Farmers Ponds to Observe Aquaculture Extension Activities of the Centre	RRC of ICAR-CIFA, Anand, Gujarat	19-21 February, 2015	P. Jayasankar
Interaction Meet of the Stakeholders for Carp and Magur Seed Production	Guwahati	23 February, 2015	N. K. Barik
Workshop on PME Indicators and Implementation Strategy	NASC, New Delhi	23 February, 2015	S. Adhikari

Agricultural Research Council Meeting of Anand Agricultural University, Anand, Gujarat	Veterinary College, AAU, Anand, Gujarat	23-24 February, 2015	C K Misra Ajit Chaudhari
Interaction Meet of the Stakeholders for Carp and Pabda Seed Production	Agartala	25 February, 2015	N. K. Barik
Farmers Meet	RRC of ICAR-CIFA, Vijayawada	26 February, 2015	P. Jayasankar
Workshop on Training Need Assessment of the HRD Nodal Officers of the ICAR Institutes	ICAR-NAARM, Hyderabad	26 February, 2015	K.N.Mohanta
National seminar on "Natural resources development strategies through biotechnological approaches"	Department of Aquaculture Management & Technology, Vidyasagar University,W.B	24 March, 2015	P. Swain
3rd Steering Committee Meeting on Tilapia	Krsihi Bhavan, New Delhi	02 March, 2015	J. K. Sundaray
International Workshop on Reuse Options for Marginal Quality Water in Urban and peri-urban agriculture and Allied Services in the Gambit of WHO Guidelines (REOPTIMA-NEW INDIGO)	IIWM, Bhubaneswar	09-10 March, 2015	S. Adhikari
12th Technical Advisory Committee meeting (TAC-12)	Bangkok, Thailand	10-12 March, 2015	P. Jayasankar
First Steering Meeting of CABin Project	ICAR-IASRI, New Delhi	12-14 March, 2015	J. K. Sundaray S. Nandi P. K. Meher
CAFT training on "Advance Tools for Analysis of Phenomic and Genomic Data'	NDRI, Karnal	5-25 March, 2015	Kiran D Rashal
Technical Programme Meeting of NICRA	ICAR-CRIDA, Hyderabad	24-25 March, 2015	S. Adhikari
Inception workshop on Consortia Research Platform on Water	ICAR-IIWM, Bhubaneswar	25-26 March, 2015	P. Jayasankar P. C. Das S. Ferosekhan

EXHIBITIONS

The Institute participated in the following exhibitions during 2014-15.

	Exhibition	Venue	Period
1.	Exhibition organized by Anand Agricultural University and District administration, Chhotaudepur (participation by RRC of CIFA, Anand)	Chhotaudepur, Gujarat	3-4 June, 2014
2.	5th Krishi Fair 2014 (organized by Shree Srikshetra Soochana Kendra, Puri)	Saradhabali, Puri	1-5 June, 2014
3.	Exhibition Stall on Aquaculture Technology	Veterinary College, Anand, Gujarat	01 July, 2014
4.	ICAR Institute-State Agriculture University (SAU)-State Department Interface Meet for the year 2014-15.	CRRI, Cuttack	21-22 October, 2014
5.	Indian Fisheries and Aquaculture Forum (10th IFAF)	NBFGR, Lucknow	12-15 November, 2014
6.	Krishi Mela 2014	GKVK, Hebbal, Bangalore	19-21 November 2014
7.	The Second International Symposium on "Marine Ecosystems- Challenges and Opportunities (MECOS2)"	Kochi, Kerala	2-5 December, 2014
8.	Kissan Mela at Astaranga	Ex-Servicemen Association, Astarang, Puri	6 December, 2014
9.	Dairy Mela organized by the ICAR-ERS-NDRI, Kalyani, Nadia, West Bengal during the occasion of Golden Jubilee Celebration.	Chandamari village, Nadia, West Bengal	11 December, 2014
10.	Exhibition during the National Workshop on "Mahseer in India: Resources, Captive Breeding, Propagation, Policies and Issues" (Organised by ICAR-Directorate of Coldwater Fisheries Research, Anusandhan Bhawan, Industrial Area, Bhimtal, Nainital, Uttarakhand)	College of Veterinary Science, Khanapara, Guwahati, Assam	22-23 December, 2014

11.	Krishi Mela (participated by RRC of CIFA, Anand, Gujarat)	Veterinary College, Anand, Gujarat	3-4 January, 2015
12.	Exhibition during 12th Agricultural Science Congress on the theme 'Sustainable Livelihood Security for Small Holder Farmers'	NDRI, Karnal	3-6 February, 2015
13.	Exhibition during Global Social Science Congress 2015 on Management of Sustainable Livelihood Systems	OUAT, Bhubaneswar	14-17 February, 2015
14.	Exhibition and Kissan Gosthi during Eastern Zone Regional Agricultural Fair	Central Patato Research Station, Patna, Bihar	19-21 February, 2015
15.	Dissemination of Aquaculture Technology (participated by RRC, Rahara)	KVK, Asoke Nagar, 24 Paraganas (North), WB	24-25 February, 2015
16.	Exhibition during Krishi Mohotshav	Janta Maidan, Bhubaneswar	5-8 March, 2015

BUDGET

Provision from the ICAR (2014-2015)

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	-							
b)	Building	-						97.86	97.86
c)	Equipments	5.0		5.0	-	-	-	18.61	17.84
d)	Furniture/Fixture	-							
e)	Info. Tech.	-						8.99	8.30
f)	Vehicle/Vessels		10.0	10.0	-	5.44	5.44		
g)	Library Books							9.54	9.54
2.	Revenue Exp.								
a)	Estt. Charges	1575.0	40.0	1615.0	15750.85	40.0	1610.85	-	
b)	Wages	62.0	-	62.0	61.14		61.14	-	
c)	OTA	0.4	-	0.4	0.29		0.29	-	
d)	Pension & Other Retirement benefits	80.0	50.0	130.0	47.66	50.00	97.66	-	
3.	Loans & Adva.	-	10.0	10.0		0.6	0.6	-	
4.	TA	8.0	2.0	10.0	7.70	2.0	9.7	30.0	29.99
5.	Other Charges								
a)	Res. Expenses	50.05	40.0	54.05	49.08	40.0	53.08	243.0	87.09
b)	Operational Expenses	70.81	85.0	155.81	70.9	85.0	155.9	105.0	260.84
c)	Admn. Expenses	250.49	18.22	268.71	211.71	18.22	229.93	140.0	138.69
d)	Misc. Expenses								
6.	HRD							15.0	14.93
7.	NEH							20.0	19.98
8.	TSP							7.0	6.74
	TOTAL	**2101.75**	**219.22**	**2320.97**	**2019.33**	**205.26**	**2224.59**	**695.0**	**691.80**

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





SUPERANNUATION
(2014-15)

- **Sri G. P. Burmon,** SSS (RRC of CIFA, Rahara) w.e.f. 30 April, 2014
- **Sri Nishamani Jena,** SSS w.e.f. 30 April, 2014
- **Sri G. Adinarayan,** SSS w.e.f. 31 May, 2014
- **Sri Bijay Bhoi,** SSS w.e.f. 31 August, 2014
- **Sri Ramesh Ch. Swain,** T-2 w.e.f. 30 September, 2014
- **Sri Sultan Khan,** SSS w.e.f. 30 September, 2014
- **Sri Ranjan Kumar Das,** SSS w.e.f. 31 October, 2014
- **Sri B. B. Ghadei,** SSS w.e.f. 31 October, 2014
- **Sri Balaram Behera,** SMS (KVK) w.e.f. 30 November, 2014
- **Sri Dil Bahadur,** SSS w.e.f. 31 December, 2014
- **Sri Rabin Kumar** Das, SSS w.e.f. 31 December, 2014
- **Sri Ramesh Jena,** SSS w.e.f. 31 January, 2015
- **Sri G. Vadivelu,** Driver (T-3) RRC of CIFA, Bengaluru took voluntary retirement w.e.f. 19 February, 2015.
- **Sri Mailge Gowda,** SSS, RRC of CIFA, Bengaluru w.e.f. 28 February, 2015.
- **Sri Gajendra Sahoo,** SSS w.e.f. 31 March, 2015

DISTINGUISHED VISITORS

Kausalyaganga, Bhubaneswar

- Sri Soumyendra Kumar Priyadarsi, IPS, IG of Police (Operations) and Sri Gyanaranjan Mohapatra, DSP (Intelligence) Govt. of Odisha on 1 November, 2014.
- Dr (Tmt) Beela Rajesh, IAS, Commissioner of Fisheries and Managing Director, Tamil Nadu Fisheries Development Corporation Ltd., Chennai during 13-15 December, 2014.
- Dr J. K. Jena, Director, ICAR-NBFGR, Lucknow, Dr T. J. Abraham, Professor, Fishery Science, WBUA&FS; Dr T. Raja Swaminathan, Sr. Scientist, ICAR-NBFGR on 12 January, 2015.
- Sri Rameshwar Singh, Project Director, ICAR-Directorate of Knowledge Management in Agriculture, ICAR, New Delhi during 10-12 March, 2015.
- Mr. Oyebola, Assistant Professor University of Ibadan, Nigeria during 21-23 June, 2014.
- Dr. Z. John Liu, Prof. from Auburn University, AL, USA on 23 January 2015.

Regional Research Centre of CIFA, Anand

- Dr S.D. Singh, ADG (I.Fy), ICAR; Dr S. Mauria, ADG (IP & TM), ICAR; Dr Rameswar Singh, PD, DKMA, ICAR; and Dr P.C. Bavgale, Head (TTD), CIAE, Bhopal visited the Regional Research Centre of CIFA, Anand, Gujarat on 13 September, 2014.

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

- Mr. Kripan Sarkar, RAC member of CIFA, visited Field Station Kalyani, CIFA on 8 July, 2014.
- Dr (Mrs.) B. Meenakumari, DDG (Fy), ICAR, and Dr P. Jayasankar, Director, CIFA visited the grow-out culture pond of hilsa at Field Station of CIFA, Kalyani on 29 June, 2014.
- On 09.07.2014 Chairman and Members of Hilsa Advisory Committee; ADG, NFBSFARA, PI and CCPIs of "Stock Characterization, Captive Breeding, Seed Production and Culture of Hilsa (*Tenualosa ilisha*)" project from lead centre and all co-operating centers visited this centre.\
- P. Lepcha, Additional Director of Fishery, Govt. of West Bengal visited this centre on 25th July 2015 and observed culture of SIFS.
- Dr. J. K. Jena, Director, NBFGR visited this centre on 29th January, 2015 and appreciated about the ongoing research on integrated farming system.

PUBLICATIONS

Research papers

Adhikari S., K.C. Pani, B. Mishra, J.K. Jena and P. Jayasankar, 2014. Carbon, nitrogen and phosphorus budget for the culture of Indian major carps with different stocking density. *Hydrobiology: Current Research,* 5(3): pp.1-6.

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Das, A., P. K. Sahoo, J. Mohanty and S. K. Garnayak, 2014. Purification and molecular characterization of IgM in olive barb, *Puntius sarana*. *J. Immunoassay Immunochem.*, **35**, pp.269–287.

Das, A., S K Mishra, R K Swain, P Swain, T Behera, 2014. Effects of organic mineral

supp.lements on growth, bioavailability and immunity in grower birds. *International J of Pharmacology*, 10(7): pp. 380-388.

Das, B. K., R.G.Neha Nidhi, Pragyan Roy, A.K.Muduli, P.Swain, S.S.Mishra and P. Jayasankar, 2014. Antagonistic activity of cellular components of *Bacillus subtilis* AN11 against bacterial pathogens. *Int. J. Curr. Microbiol. App. Sci* ; 3(5): pp.795-809.

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Das, S., C. Chhottaray, K. D. Mahapatra, J.N. Saha,., Baranski, M., Robinson, N. and Sahoo, P.K. 2014. Analysis of immune-related ESTs and differential expression analysis of few important genes in lines of rohu (*Labeo rohita*) selected for resistance and susceptibility to *Aeromonas hydrophila* infection. *Molecular Biology Reports,* (DOI 10.1007/s11033-014-3625-4).

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Mohanty, B.R., Sahoo, M., Sahoo, P.K., Mahapatra, K.D. and Saha, J.N. (2014). Reference ranges and seasonal variations in innate immune responses of kalbasu, *Labeo calbasu* (Hamilton). *Indian J. Fish.*, 61: pp. 57-62.

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(OMPA)gene Partial cds. KM267628.

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PERSONNEL

(as on 31.3.2015)

Director

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Head of Division

Dr S. S. Giri
Dr J. K. Sundaray
Dr S. S. Mishra
Dr Bindu R. Pillai

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 (Vigilance Officer)
Dr K. D. Mohapatra
Dr P. Das
Dr P. V. Rangacharyulu
Dr P. P. Chakraborty
Dr (Mrs) Saroj Toppo
Dr S. Adhikari
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
Sri P. K. Meher
Dr R. N. Mondal
Dr Ashis Saha
Dr J. N. Saha
Dr M. Samanta
Dr Gangadhar Barlaya
Dr Chandra Kanta Misra
Dr K. C. Das
Dr B. S. Giri

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.
Dr Ramesh Rathod
Dr Subhas Sarkar
Dr Khuntia Murmu
Sri Ferose Khan
Sri Nitish Ku. Chandan
Sri Kiran Dashrath Rasal
Sri Anantharaj K.
Sri Ch. Ajit Keshav
Sri Arabinda Das
Sri Uday Ku. Udit
Sri Rakesh Das
Sri I. Sivaraman
Sri Mukesh Ku. Bairwa
Dr Suhas Prakash Kamble
Sri Badhe Mohan Ramesh
Mrs Rakhi Kumari
Mrs P. C. Nandanpawar
Dr B. S. Anand Kumar

Chief Technical Officer (T-9)

Ms B. L. Dhir

Asst. Chief Technical Officer Technical (T-7-8)

Sri A. K. Dash
Sri Surendra Singh
Dr B. K. Banja
Sri Satyendu Sarkar
Dr N. Panda
Dr B. K. Pandey

Sr. Technical Officer (T-6)

Ms Sukanti Behera
Sri Suresh Chand (upto 28.2.2015)
Dr D. K. Verma
Dr U. L. Mohanty
Sri P. R. Sahu

Technical Officer (T-5)

Sri S. Mahali
Sri Sovan Sahoo
Sri D. P. Rath
Sri S. K. Mohanty
Sri P. B. Bhakat
Dr Bibhudatta Mishra
Sri Santosh K. Nayak
Sri Suratha K. Naik

Sr. Technical Asst. (T-4)

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

Technical Asst. (T-3)

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

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 (upto 9.2.2015)
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 (upto 11.6.2014)

Finance and Accounts Officer

Sri N. V. R. N. Murty

Asst. Finance & Accounts Officer

Sri S. S. Mahapatra

Private Secretary

Sri M. D. Das

Asst. Administrative Officers

Sri J. R. Biswal (AO in Charge)
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 Majoj Ku. Mohapatra

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 Prakash Ch. Parida
Sri Jogendra Dalai

Personal Assistant

Ms A. Manjula
Ms Singa Soren
Ms Smita Acharya

Skilled Support Staff

Sri Malige Gowda (upto 28.2.2015)
Sri K. C. Jally
Sri Sital Ch Haldar
Sri Teegala Muthyullayya

Sri Debahari Behera
Sri Jaydev Paria
Sri G. C. Mallick
Sri B. B. Pandit
Sri Sudam Behera
Sri P. K. Nayak
Sri Rajan Swain
Sri Pitambar Swain
Sri Ramesh Ch Ghadei
Sri Pasupati Das
Sri Banamali Mallick
Sri G. K. Sahoo
Sri Resham Bahadur (I)
Sri Biswanath Haldar
Sri Trinath Pradhan
Sri R. K. Sahoo
Sri Kapilash Barik
Sri Resham Bahadur (II)
Sri Kailash Ch Jena
Sri Rahaman Shariff
Sri H. K. Behera
Sri Golekha Behera
Sri Purna Bhoi
Sri Muralidhar Bhoi
Sri Sridhar Kahali
Sri A. K. Rout
Sri Gayadhar Behera
Sri Basudev Routray
Sri Satrughan Bhoi

Sri Prahallad Swain
Sri Chandramani Muduli
Sri Surendra Swain
Sri Jagannath Ojha
Sri Trailokya Nath Pradhan
Sri Haren Sardar
Sri Siddaraju
Sri Ulash Bhoi
Sri Paresh Samanta
Sri Rabindra Kumar Nath
Sri Sudarshan Muduli
Sri R. C. Mallick
Sri Asit Kumar Pal
Sri Gundicha Prusty
Sri Bhagaban Swain
Sri Jagannath Ghadei
Sri Lokanath Swain
Sri Damodar Ghadei
Sri Dilip Das
Sri Ratan Das
Sri Ajit Kumar Ray
Sri Dilip Ch. Chanda
Sri Saroj Kumar Parida
Sri Sarat Ch. Barik
Ms Manju Singh
Ms Sandhya Ghosh
Sri Gopal Ch. Mohapatra
Sri Gouriguru Sibananda Bhuyan
Sri Baikuntha Nayak

Sri Manoj Kumar Jena
Sri Ch. M. Rao
Sri Budhia Behera
Sri Bauri Bandhu Pradhan
Sri Aruna Kumar Muduli
Sri Tanay Balav Barik
Md. Mohibullah
Sri M. Narasimhaluru
Sri Prasanna Ku. Behera
Sri P. Rajasekhar
Ms Sonali Adhikari
Sri Samir Das
Sri Nabaghana Ghadei
Ms Kalyani Mondal
Ms Kiron Oraon
Sri Sanatan Pradhan
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
Sri Baja Muduli

Staff Transferred from Regional Research Centre of CIBA, Puri

Sri P. C. Mohanty, T-2 (Driver)
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	1.4.2011-1.3.2015
2.	I-59	Genetic upgradation of freshwater fish and shellfish	P. Jayasankar	
		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	1.4.2011-1.3.2015
		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	1.4.2012-31.3.2016
		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
		s) Single nucleotide polymorphism discovery in *Labeo rohita* and *Macrobrachium rosenbergii*	P. Das	1.4.2013-31.3.2016
		t) Effect of 'CIFABROOD' on the breeding performance and seed quality of Jayanti rohu (*Labeo rohita*)	J. N. Saha	1.4.2014-31.3.2017

3.	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
4.	I-80	Sustainable freshwater aquaculture		
		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. Chakroborty	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
5.	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
6.	I-82	Development of PCR based diagnostics of *Aeromonas hydrophila* infection in freshwater fish species.	M. Samanta	1.4.2012-31.3.2015
7.	I-83	Development of a Database and Information System for Institute's Publications	A. S. Mohapatra	1.4.2012-31.3.2015
8.	I-84	Aquaculture development through participatory approach		
		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
9.	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
10.	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
11.	I-87	Tribal Sub-Plan (TSP) project	B. C. Mohapatra	1.4.2013-31.3.2016
12.	I-88	Integrated disease management of freshwater aquaculture	S. S. Mishra	
		a) Characterization of gill associated fish pathogens and their diagnosis and control measures	S. S. Mishra	
		b) Development of biocontrol agents against important fish pathogens and their application in aquaculture	B. K. Das	
		c) Bacterial bio-remediation of inorganic pollutants from freshwater ecosystem	N. K. Maiti	
13.	I-89	Neuroendocrine regulation of gonadal maturation through environmental manipulation during out of breeding season in catla	Asish Saha	1.4.2014-31.3.2017
14.	I-90	Development of low cost feeds for *Macrobrachium rosenbergii* culture	P. V. Rangacharyulu	1.4.2014-31.3.2017

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-61	Intellectual Property Management and Transfer / Commercialization of Agricultural Technology	ICAR XIth Five Year Plan Scheme	P. Swain	2009- March, 2015
4.	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, 2015
5.	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
6.	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 – June, 2014
7.	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
8.	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
9.	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-March, 2015
10.	E-74	Development of molecular marker-based seed identification system of cultured carps (Cyprinidae)	DST, Govt. of India	P. Jayasankar	September 2011-September, 2014
11.	E-75	Production of antiviral Mx protein in carps	Dept. of Biotechnology, Govt. of India	B. K. Das	September 2011-March, 2015
12.	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 – July, 2015
13.	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 – June, 2015

14.	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
15.	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
16.	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
17.	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 – August, 2016
18.	E-82	Business planning and development centre for aqua-entrepreneurship	NAIP	N. K. Barik	2013- June, 2014
19.	E-83	Diversity and synthesis of immunoglobulin in the Indian major carps	NFBSFARA	M. Samanta	April 2013 March 2017
20.	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
21.	E-86	National Surveillance programme on Aquatic animal diseases	NFDB-NBFGR	P. K Sahoo	2013-March, 2017
22.	E-87	Joint Implementation of Agricultural Livelihood Support Services (ALSS) Component of OCTMP in Khordha district	Orissa Community Tank Management Project	P. N. Ananth	2013-2015
23.	E-88	Carp seed production in FRP hatchery and development of SC/ST communities in Khurda District of Odisha	Ministry of Science and Technology, DBT	B. C. Mohapatra	July 2014 – June 2017
24.	E-89	Assessment of the socio-economic impact of FMD and its control in India	National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI Formerly PADADMS, ICAR, Bangalore	P. N. Ananath	June 2014- March 2015
25.	E-90	Risk and benefit assessment on an illegally introduced fish species Pacu (*Piaractus branchypomus*) in India	NFDB (Collaborative Project with NBFGR, Lucknow)	B. S. Giri	2014-2016

कार्यकारी सारांश

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

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

ख. क्षेत्रीय केन्द्र :

i) **क्षेत्रीय अनुसंधान केन्द्र**
रहरा मत्स्य प्रक्षेत्र, रहरा-743186, पश्चिम बंगाल
(क्षेत्रीय अनुसंधान केंद्र का फील्ड स्टेशन, रहरा:
ए/5 फेज – III, संथालपारा, नदिया,
कल्याणी-741 235 पश्चिम बंगाल)

ii) **क्षेत्रीय अनुसंधान केन्द्र**
हेसरघट्टा लेक, बैंगलुरु-560089, कर्नाटक

iii) **क्षेत्रीय अनुसंधान केन्द्र**
पेनामलरू मत्स्य बीज प्रक्षेत्र, पेनामलरु
विजयवाड़ा-521131, आंध्र प्रदेश

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

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

2. बजट (2014-15)

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
695.00	691.80	2101.75	209.22	2310.97	2019.34	204.66	224.00

बी. वाह्य श्रोत (रू.लाख में)

स्त्रोत	राशि
बी.टी.आई.एस.	-
पेंसन और अन्य सेवानिवृत लाभ	97.66
भा.कृ.अनु.प./एपीए/आईपीआर/एनएफबीएसएफएआरए/केवीके/एनएआईपी(योजनागत	166.46
गैर योजनागत	63.11
निजी ऋण और अग्रिम राशि	5.09
बाह्य वित्त पोषित परियोजनांए	502.88
कुल	**835.20**

सी. राजस्व प्राप्ति (2014-15) (रू.लाख में)

स्त्रोत	राशि
प्रक्षेत्र उत्पाद	5.69
मत्स्य एवं मुर्गी विक्रय	12.83
वाहन/अन्य मशीन सामग्री विक्रय	-
प्रकाशन विक्रय	0.03
लाइसेन्स शुल्क/जल मुल्य	12.39
परीक्षण विश्लेषण शुल्क	0.37
निविदा फार्म मूल्य	2.68
सेवा प्रदान	0.65
प्रशिक्षण	5.62
विविध	1.35
ऋण एवं अग्रिम राशि पर ब्याज	10.16
टी.डी. आर. पर व्याज	30.88
अन्य (रॉयल्टी और संस्थान शुल्क)	56.72
कुल :	**139.37**

3. कर्मचारियों की संख्या (31.3.2015 तक)

श्रेणी	मंजूरी	स्थिति	रिक्त
वैज्ञानिक			
निदेशक	1	1	0
प्रभागाध्यक्ष	4	4	0
प्रधान वैज्ञानिक	2	0	2
वरिष्ठ वैज्ञानिक	12	10	2
वैज्ञानिक	60	53	7
कुल	79	68	11
श्रेणी (तकनीकी कर्मचारी)			
टी-6	4	0	4
टी-3	23	13	10
टी-2	3	3	0
टी-1 (ड्राइवर सहित)	21	15	6
कुल	51	31	20
श्रेणी (प्रशासनिक कर्मचारी)			
वरिष्ठ प्रशासनिक अधिकारी	1	0	1
प्रशासनिक अधिकारी	1	0	1
वित्त एवं लेखा अधिकारी	1	1	0
सहायक प्रशासनिक अधिकारी	5	3	2
सहायक वित्त एवं लेखा अधिकारी	1	1	0
सुरक्षा अधिकारी	1	1	0
निजी सचिव	1	1	0
व्यक्तिगत सहायक	3	3	0
सहायक	10	7	3
वरिष्ठ लिपिक	6	6	0
कनिष्ठ आशुलिपिक	1	0	1
कनिष्ठ लिपिक	6	3	3
कुल	37	26	11
सहायक			
कुशल सहायक कर्मचारी	120	83	37
ग. कुल	**287**	**208**	**79**

कृषि विज्ञान केन्द्र में कर्मचारियों की संख्या (31.3.2015 तक)

श्रेणी	मंजूरी	स्थिति	रिक्त
वैज्ञानिक			
कार्यक्रम संचालक	1	1	0
तकनीकी			
विषय वस्तु विशेषज्ञ	6	3	3
कार्यक्रम सहायक	3	2	1
टी-1 (वाहन चालक)	2	2	0
प्रशासनिक			
सहायक	1	0	1
कनिष्ठ आशुलिपिक	1	1	0
सहायक			
कुशल सहायक कर्मचारी	2	2	0
कुल	**16**	**11**	**5**

4. अनुसंधान परियोजनांए

(क) संस्थान अधारित : 14

(ख)बाह्य वित्त पोषित : 25

5. प्रशिक्षण कार्यक्रम आयोजित

स्तर	कार्यक्रमों की संख्या	प्रतिभागियों की संख्या
राष्ट्रीय	20	334
अंतर्राष्ट्रीय	1	2

6. मानव संसाधन विकास

राष्ट्रीय स्तर पर प्रशिक्षत व्यक्तियों की संख्या : 12

अंतर्राष्ट्रीय स्तर पर प्रशिक्षत व्यक्तियों की संख्या : -

7. कार्यशालाओं का आयोजन

राष्ट्रीय : 2

अन्तर्राष्ट्रीय : 2

8. संगोष्ठियों/सेमिनार /कार्यशालाओं आदि में भागिदारी

स्तर	प्रतिभागियों की संख्या
राष्ट्रीय	50
अंतर्राष्ट्रीय	03

9. ढाँचागत विकास

- समिति और सम्मेलन हॉल का नवीकरण
- एनएफडीबी परियोजना के तहत मत्स्य आनुवंशिक एवं प्रौद्योगिकी प्रभाग के लिए प्रायोगिक टैंक का निर्माण
- सीफा मुख्यालय में टाइप –III क्वार्टर की मरम्मत
- मत्स्य पोषण एवं शरीर क्रिया विज्ञान प्रभाग की प्रायोगिक तालाब का नवीकरण
- क्षेत्रीय अनुसंधान केंद्र, रहरा और कल्याणी में प्रायोगिक टैंक का निर्माण

10. मुख्य अनुसंधान उपलब्धियाँ

- हार्मोन (एचसीजी और कार्प पीजी) खुराक, आहार और अलग करना सहित स्ट्रीप्ड स्नेकहेड *चन्ना स्ट्रेटस* की कैप्टीव प्रजनक मछलियों को बढ़ाने के लिए पालन पद्धतियों के पैकेज का विकास।
- रोहू और कतला के प्रत्यारोपित सरोगेट प्रजनक मछलियों के युग्मक से फ्राई और फिंगरलिंग का उत्पादन किया।
- भारी धातु दूषित अपशिष्ट जल के सुधार के लिए कम लागत की बायो-सोरबेंट का विकास किया गया।
- मीठाजल मोती उत्पादन के लिए जैव –अनुकूल डाइजेस्टर न्युकिलस नाभिक का विकास किया गया।
- उन्नत पैदावार वजन के लिए चयनित प्रजनित मीठाजल झींगा *मैक्रोब्रेंकियम रोजनवर्गी* के 6वीं पीढ़ी के 59 फैमिली का उत्पादन किया।
- फोटोथर्मल हेरफेर का उपयोग कर *क्लेरियस बाट्राकस* लार्वा का उत्तरजीवित्ता और विकास में सुधार ।
- ग्रो-आउट चरण के दौरान इष्टतम प्रतिपूरक विकास के लिए रोहू बीज स्टंटींग की आदर्श अवधि को मानकीकृत किया गया।
- मत्स्य अपशिष्ट से फिश बायोफर्ट नामक पाउडर जैविक खाद्य और फिश हाइड्रोलाइसेट नामक तरल खाद्य का विकास किया ।
- बेबीकार्न, सूरजमुखी, उच्च मूल्य वाली फसलों के साथ एकीकृत मत्स्य खेती के लिए ग्रीष्मकालीन फसल मॉडल को विकसित किया गया।

- रंगीन मछली पालन प्रौद्योगिकी के हस्तांतरण के लिए बारकोट प्रखंड, देवगड़ जिला में अतितिक्त गांवों को अंगीकृत किया गया।
- भारत में पहली बार, आधार जनसंख्या के आठ स्टॉको से 50 फुलसिब फैमिली के साथ कतला चयनात्मक प्रजनन की शुरुआत और उन्नत रोहू के साथ एकलपालन और बहुपालन खेती की शुरुआत की गई।
- कुल 3.4 मिलियन पीढ़ी-1 (विकास के लिए चयनित) कतला और 29.95 मिलियन विकास उन्नत रोहू बीज की आपूर्ति भारत के विभिन्न भागों में कृषक समुदाय के लिए किया गया।
- रोहू में उच्च थ्रूपुट सिक्वेंसिंग का उपयोग कर 143.7 मिलियन रीडस और 2, 03,560 एसएनपीएस और मीठाजल महाझिंगा में 199.5 मिलियन रीडस और 2, 61,445 एसएनपीएस की पहचान की गई।
- रोहू के पूर्ण जीनोम अनुक्रमण के लिए ~110X कवरेज के साथ अनुक्रम डेटा की कुल 154.5 जीबी उत्पादित किया और 46,173 एसएनपीएस और 39,742 एसएसआरएस को उत्पन्न किया।
- पहली बार, न्यूक्लियोफेक्सन का उपयोग कर अभिकर्मक प्रोटोकॉल को रोहू स्पर्मेटोगोनियल स्टेम कोशिकाओं के के लिए अनुकूलित किया गया।
- कतला और रोहू की निषेचित भ्रूण में टीएलआर 22 को एकीकृत करने के लिए प्रभावी ढ़ंग से जीन लक्षित तकनीक को इस्तेमाल किया गया।
- जनसंख्या आनुवंशिक अध्ययन से सभी प्रायद्वीपीय नदियों के भारतीय प्रमुख कार्प के मिश्रण का पता चला चूंकि वे आम पूर्वज से विकसित हो सकते है।
- पहली बार , सीफाब्रूड आहार का उपयोग कर *सिल्वर बार्ब* का शीघ्र और पुनरावृति प्रजनन हासिल किया और पश्चिम बंगाल में वाणिज्यिक ऑपरेटर द्वारा *सिल्वर बार्ब* का 12 मिलियन स्पॉन का उत्पादन किया गया।
- जलीय पौधों में पाई गई एंटीऑक्सीडेंट को मत्स्य आहार में शामिल किया जा सकता है।
- उन्नत रोहू , जयंति फ्राई के लिए प्रोटीन और कार्बोहाइड्रेट स्तर की इष्टतम आवश्यकता क्रमशः 35% और 30%, के रुप में पाया गया।
- 30-40% के स्तर पर कार्प आहार में महुआ खल्ली समावेस अंगुलिकाओं के विकास और उत्तरजीविता पर कोई प्रतिकूल प्रभाव नही पड़ेगा।
- मत्स्य आहार पर आउटरीज कार्यक्रम के तहत ओडिशा, पश्चिम बंगाल और छत्तिशगढ़ में प्रक्षेत्र आहार प्रदर्शन, प्रशिक्षण और जागरूकता कार्यक्रम का आयोजन किया गया।
- फोटोथर्मल हस्तक्षेप के माध्यम से जनवरी में कतला का प्रेरित प्रजनन कराया गया।
- मछलियों में *एरोमोनास हाइड्रोफिला* संक्रमण की पसीआर-आधारित निदान के लिए ओएमपी और पोलर फ्लेजीला को वायरुलेंस संबधित जीन मार्कर के रुप में पहचान की गई।
- कई एंटीबायोटिक, एक सार्वजनिक स्वास्थ्य चिंता का विषय के विरुद्ध गिल से जुड़े जीवाणु आइसोलेटस ने प्रतिरोध दिखाया और एक नई मिक्जोलस प्रजातियों को पृथक किया गया।
- पृथक स्ट्रेन *बेसिलस सबटिलिस* (एन 11) जलकृषि में एक संभावित जैव-नियंत्रण एजेंट हो सकता है।
- अपशिष्ट जल अवसादों से कुछ बैक्टीरिया आइसोलेटस ने 30-48 घंटे के इनकुबेशन के भीतर उच्च नाइट्रीकरण और डी-नाइट्रीकरण गतिविधि को दर्शाया है।
- संश्लेषित जींक ऑक्साइड और कॉपर ऑक्साइड नैनोकणों के जलीय कृषि उपकरणों के कोटिंग पर व्यापक स्पेक्ट्रम एंटीबायोटिक, एंटीफंगल और एंटी-अलगल गुणो और बेहतर हैंचिग और उत्तरजीविता को दर्शाया।
- आरगुलस संक्रमन ने रोहू के त्वचा, म्युकस और गुर्दा उत्तक में कई इम्युनोग्लोबुलिन टाइप (आईजीडी, आईजीएम और आईजीडी) अभिव्यक्ति को प्रेरित किया जो संक्रमण प्रक्रिया के दौरान स्थानीय और प्रणालीगत प्रतिरक्षा की भूमिका का संकेत है।
- आठ कार्प प्रजातियों के साथ आयोजित प्रायोगिक परीक्षण में *आरगुलस सियामेनसिस* संक्रमण में रोहू अतिसंवेदनशील प्रजाती पाया गया।
- सक्रिय लक्षित रोग निगरानी तहत, कार्प के 190 नमूने में पीसीआर/आरटी-पीसीआर में एसभीसीभी के लिए नकरात्मक और केएचभी के लिए 182 पाया गया
- मीठाजल मछली की पैदावार-उपरांत मूल्य वर्धित प्रौद्योगिकी पर महिलाओं के लाभार्थियों को व्यावहारिक प्रशिक्षण प्रदान किया गया।
- आनुवंशिक तौर पर उन्नत रोहू (जयंति) स्पॉन का नर्सरी पालन पर प्रक्षेत्र प्रदर्शन किया गया और नर्सरी संवर्धन के एक महीने बाद गुजरात के खेड़ा और आनंद जिलो के गांव के तालाबों में उत्तरजीविता क्रमशः 41% और 55% पाया गया।

RESULTS-FRAMEWORK DOCUMENT FOR ICAR-CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE

(RFD)
RESULTS-FRAMEWORK DOCUMENT FOR ICAR-CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE (2013-2014)
Kausalyaganga, Bhubaneswar, Khurda-751002 (ODISHA)

Section 1:
Vision, Mission, Objectives and Functions

Vision

- To make Indian freshwater aquaculture globally competitive through eco-friendly and economically viable fish production systems for livelihood and nutritional security.

Mission

- Excellence in research for developing sustainable and diversified freshwater aquaculture practices for enhanced productivity, quality, water use efficiency and farm income.

Objectives

- Development of freshwater aquaculture technologies for increasing production and productivity.
- Transfer of aquaculture technologies and commercialization.

Functions

- To attend to all aspects of freshwater aquaculture research towards enhancing production and productivity.
- To provide training and consultancy in the areas of freshwater aquaculture.

Section 2: Inter-se Priorities among Key Objectives, Success Indicators and Targets

Sl. No.	Objectives	Weight	Actions	Success Indicators	Unit	Weight	Target / criteria value				
							Excellent	Very good	Good	Fair	Poor
							100%	90%	80%	70%	60%
1.	Development of freshwater aquaculture technologies for increasing production and productivity	69	Technological interventions to enhance quality and production	Improved/diversified fish species for quality seed production	Number	25	3	2	1	0	0
				Environmental manage-ment measures taken	Number	16	3	2	1	0	0
				Feed formulations/feeding strategies developed	Number	16	3	2	1	0	0
				Health care measures developed	Number	12	3	2	1	0	0
2.	Transfer of aquaculture technologies and commercialization	20	Commercialization of aquaculture technologies	Product/process developed/commercialized	Number	8	3	2	1	0	0
			Capacity building and skill development of stake holders	No. of stakeholders trained	Number	12	210	200	180	170	160
	Efficient Functioning of the RFD System	3	Timely submission of Draft RFD (2013-14) for approval	On-time submission	Date	2	15/05/ 2013	16/05/ 2013	17/05/ 2013	20/05/ 2013	21/05/ 2013
			Timely submission of Results for RFD (2012-13)	On-time submission	Date	1	01/05/ 2013	02/05/ 2013	05/05/ 2013	06/05/ 2013	07/05/2 013
	Administrative Reforms	4	Implement ISO 9001 as per the approved action plan	% Implementation	%	2	100	95	90	85	80
			Prepare an action plan for Innovation	On-time submission	Date	2	30/07/ 2013	10/08/ 2013	20/08/ 2013	30/08/ 2013	10/09/2 013
	Improving internal efficiency/ responsiveness / service delivery of Ministry / Department	4	Implementation of Sevottam	Independent Audit of Implementation of Citizen's Charter	%	2	100	95	90	85	80
				Independent Audit of implementation of public grievance redressal system	%	2	100	95	90	85	80

Section 3: Trend Values of the Success Indicators

Sl. No.	Objectives	Actions	Success Indicators	Unit	Actual value 2011-12	Actual value 2012-13	Targeted value 2013-14	Projected value 2014-15	Projected value 2015-16
1	Development of freshwater aquaculture technologies for increasing production and productivity	Technological interventions to enhance quality and production	Improved/diversified fish species for quality seed production	Number	5	2	2	2	2
			Environmental management measures taken	Number	3	2	2	2	2
			Feed formulations/feeding strategies developed	Number	2	2	2	2	2
			Health care measures developed	Number	2	2	2	2	2
2	Transfer of aquaculture technologies and commercialization	Commercialization of aquaculture technologies	Product/process developed/commercialized	Number	2	2	2	2	2
		Capacity building and skill development of stake holders	No. of stakeholders to be trained	Number	189	200	200	225	230
	Efficient Functioning of the RFD System	Timely submission of Draft RFD (2013-14) for approval	On-time submission	Date	-	-	16/05/2013	-	-
		Timely submission of Results for RFD (2012-13)	On-time submission	Date	-	-	02/05/2013	-	-
	Administrative Reforms	Implement ISO 9001 as per the approved action plan	% Implementation	%	-	-	95	-	-
		Prepare an action plan for Innovation	On-time submission	Date	-	-	10/08/2013	-	-
	Improving internal efficiency /responsiveness / service delivery of Ministry / Department	Implementation of Sevottam	Independent Audit of Implementation of Citizen's Charter	%	-	-	95	-	-
			Independent Audit of implementation of public grievance redressal system	%	-	-	95	-	-

Section 4 : Acronyms

S. No.	Acronym	Description
1	NFDB	National Fisheries Development Board
2	CIFA	Central Institute of Freshwater Aquaculture
3	FRP	Fibre-glass Reinforced Plastics
4	NGO	Non-Governmental Organizations
5	CIFAX	It is a medicine developed by CIFA for EUS but not an acronym.

Section 4 : Description and Definition of Success Indicators and Proposed Measurement Methodology

Sl.No	Success indicator	Description	Definition	Measurement	General Comments
1	Improved/diversified fish species for quality seed production	Improvement of the existing species and diversification of the species are important for quality seed production.	Diversification of species are new addition of species to the existing culture system. Improvement is through genetic upgradation.	Number of new/improved species to be added	Improvement is result of breeding improvements, can include high quality, better disease resistance, etc. Diversification includes introduction of new species to the existing culture system
2	Environmental management measures taken	Newer management strategies to be followed to manage the culture environment for better production of fish		Number	
3	Feed formulations/feeding strategies developed	Development of new feed formulations and feeding strategies from locally available ingredients	Locally available means on-site cheap plant based feed ingredients	Number	
4	Health care measures developed	The development of diagnostic kits/medications/health care measures would involve delineation of process (processes) for detection of specific diseases of fish and thereby denoting a specific number for field testing / validation through various institutes, State fisheries Departments, private production houses/industry	To develop sensitive tests/formula for detection of causative agents/treatment for specific diseases of fish, respectively	Number	Development of new diagnostics/prophylactics will be need based dependent on occurrence / emergence /prevalence / severity of a disease likely to result in high economic loss
5	Product/process developed/commercialized	Certain products and process may be directly developed from the project which is reflected in patents filed & usable product and process developed	-	Number	-
6	No. of stakeholders trained	Capacity building activities related to knowledge and skill improvement/development programmes conducted for farmers, rural youth and extension personnel	Training is a process of acquisition of new skills, attitude and knowledge in the context of preparing for entry into a vocation or improving productivity in an organization or enterprise	Number	-

Section 5 : Specific Performance Requirements from other Departments

Location Type	State	Organisation Type	Organisation Name	Relevant Success Indicator	What is your requirement from this organisation	Justification for this requirement	Please quantify your requirement from this Organisation	What happens if your requirement is not met.
State Government	All states	Department	Fisheries departments	No. of stake holders to be trained	Sponsorship of stakeholders for training	Regulate the no. of programmes to be conducted	No. of persons to be trained as per the indent	Less or more number of stakeholders will be trained.

Section 6 : Outcome / Impact of activities of organization

Sl. No	Outcome/Impact of organization	Jointly responsible for influencing this outcome/impact with the following organization(s)/departments/ministries	Success indicators	Unit	2011-12	2012-13	2013-14	2014-15	2015-16
1	Increase in fish yield, profitability, improvement in socio-economic status of fish farmers	State governments/NFDB/ Farmers/NGOs	Areas of ponds adopted CIFA technologies (new species, improved variety, seeds from FRP hatchery, CIFAX etc)	ha	5370	6040	6710	7380	7940
			Additional profit from adoption of CIFA technologies	(lakhs rupees)	3050	3420	3790	4160	4380

Section 4:
Description and Definition of Success Indicators and Proposed Measurement Methodology

The success indicators are envisaged based upon their timely approval, timely appointment of research/technical/other staff, timely procurements, approval of layout plans, initiation and completion of works, timely procurement of instruments and chemicals etc.

Objective 1: Development of freshwater aquaculture technologies for increasing production and productivity would mostly include technological interventions to enhance quality and production of fish through incorporation of new candidates or improvement of existing breed quality, standardization of their seed production technology and aspects related to the nutrient management for productivity improvement. The new species could be included into the culture system only after detailed study on their biology, seed production and grow-out performance. Formulation of low cost feed formulations and feeding strategies will be made through evaluation and incorporation of locally available alternate feed ingredients, floating or sinking pellets. The success indicators for health management will cover development of diagnostics, production of bioactive compounds from aquatic algae, and probiotics for better environment management, training programme for capacity building and skill upgradation for state officials involved in fish health management. It would be measured through development of number of diagnostics, purification and characterization of bioactive compounds to destroy fish pathogens, and conducting training for state officials.

Objective 2: The success indicators will cover product/process development and commercialization and filing of patents. This will be measured through number of products commercialized and number of applications filed. Dissemination of freshwater aquaculture technologies will be done through field days, exposure visits, extension and mass media, organize training programmes and demonstration of aquaculture technologies. It will be measured through number of training programmes to be organized and number of people participating in extension programmes.

Section 5:
Specific Performance Requirements from other Departments

Some of the targets are carried out under funding support from different national/international agencies. Hence, timely release of funds would be crucial for realization of achieving the targets. Active support from state fisheries departments and National Fisheries Development Board (NFDB) is very much essential for up-take and further spread of Institute's technologies throughout India.

Section 6: Outcome/Impact of activities of organization/ministry

1	2	3	4	5	6	7	8	9	10
Sl. No	Outcome/ Impact of organization /RCs	Jointly responsible for influencing this outcome/impact with the following organization(s)/departments/ministries	Success indicators	Unit	2011- 12	2012-13	2013-14	2014-15	2015-16
1	Increase in fish yield, profitability, improvement in socio-economic status of fish farmers	State governments/NFDB/ Farmers/ NGOs	Areas of ponds adopted CIFA technologies (new species, improved variety, seeds from FRP hatchery, CIFAX etc)	ha	5370	6040	6710	7380	7940
			Additional profit from adoption of CIFA technologies	(lakhs rupees)	3050	3420	3790	4160	4380

Annual (April 1, 2013 to March 31, 2014) Performance Evaluation Report in respect of RFD 2013-2014 of RSCs i.e. Institutes

Name of the Division: Fisheries

Name of the Institution: Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar

Sl. No	Objectives	Weight (%)	Action(s)	Success Indicator(s)	Unit	Weight (%)	Target / criteria value					Achievements	Performance	
							Excellent	Very good	Good	Fair	Poor			
							100%	90%	80%	70%	60%		Raw Score	Weighted score
1.	Development of freshwater aquaculture technologies for increasing production and productivity	69	Technological interventions to enhance quality and production	Improved/diversified fish species for quality seed production	Number	25	3	2	1	0	0	3	100	25
				Environmental management measures taken	Number	16	3	2	1	0	0	3	100	16
				Feed formulations/feeding strategies developed	Number	16	3	2	1	0	0	3	100	16
				Health care measures developed	Number	12	3	2	1	0	0	2	90	10.8
2.	Transfer of aquaculture technologies and commercialization	20	Commercialization of aquaculture technologies	Product/process developed/commercialized	Number	8	3	2	1	0	0	3	100	8
			Capacity building and skill development of stake holders	No. of stakeholders trained	Number	12	210	200	180	170	160	497	100	12

3.	Efficient Functioning of the RFD System	3	Timely submission of Draft RFD (2013-14) for approval	On-time submission	Date	2	15/05/2013	16/05/2013	17/05/2013	20/05/2013	21/05/2013	01.05.2013	100	2
			Timely submission of Results for RFD (2012-13)	On-time submission	Date	1	01/05/2013	02/05/2013	05/05/2013	06/05/2013	07/05/2013	23.04.2013	100	1
4.	Administrative Reforms	4	Implement ISO 9001 as per the approved action plan.	% Implementation	%	2	100	95	90	85	80	100	100	2
			Prepare an action plan for Innovation	On time submission	Date	2	30/07/2013	10/08/2013	20/08/2013	30/08/2013	10/09/2013	30/07/2013	100	2
5.	Improving Internal Improving Internal Efficiency/ responsiveness / service delivery of Ministry / Department	4	Implementation of Sevottam	Independent Audit of Implementation of Citizen's Charter	%	2	100	95	90	85	80	100	100	2
				Independent Audit of implementation of public grievance redressal system	%	2	100	95	90	85	80	100	100	2

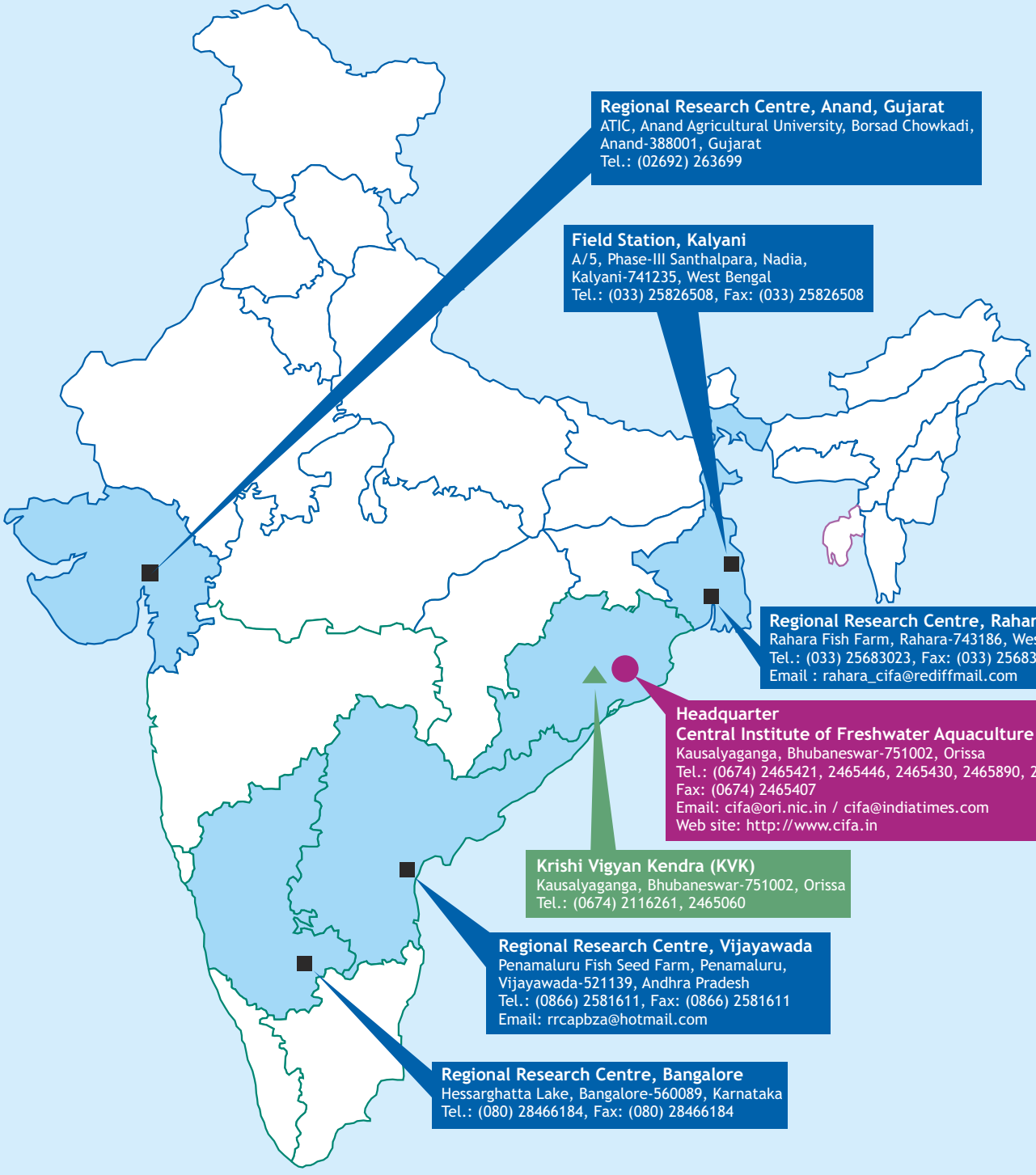
Total Composite Score: 98.8
Rating: Excellent

SWACCH BHARAT ABHIYAN

The launching of the Swacch Bharat Programme was conducted at the Institute Headquarters and its Regional Research Centres at Rahara (WB), Bangalore (Karnataka), Vijayawada (AP) and Anand (Gujarat) on Gandhi Jayanti, i.e., 2 October, 2014 with wholehearted participation of all the employees. It was decided that the cleaning process at the headquarters in Kausalyaganga would be divided into 9 Zones covering the entire campus. All the employees undertook a pledge to devote two hours per week to maintain the cleanliness of the Institute campus.


स्वच्छ भारत अभियान
SWACHH BHARAT ABHIYAN

RESEARCH LOCATION



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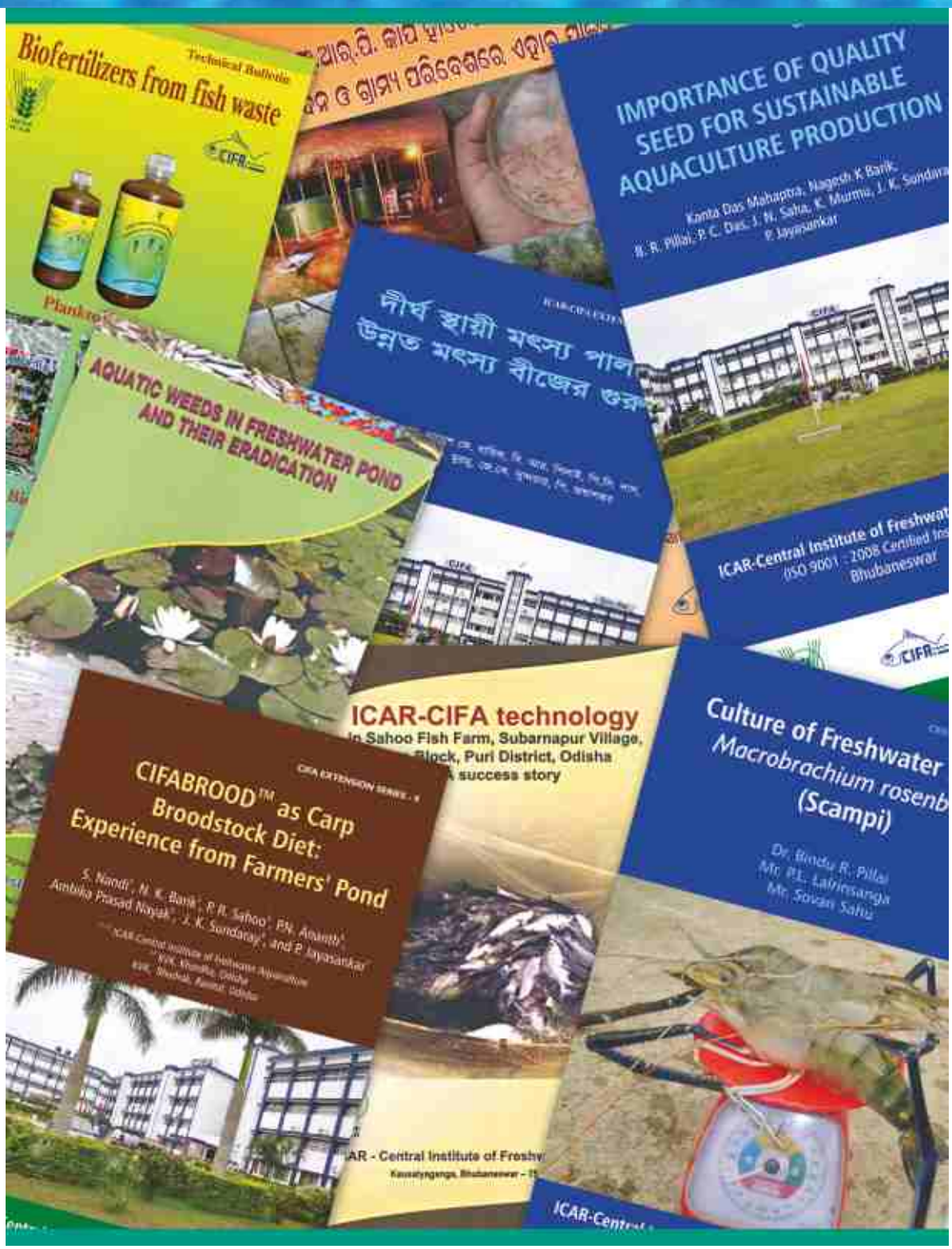
CIFA in Media

An Approach Towards "Farmers First"



Commercialised Technology Towards Entrepreneurship Development

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