



वार्षिक प्रतिवर्दन
Annual Report
2007-08

ANNUAL REPORT

2007 - 2008



CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE
(*Indian Council of Agricultural Research*)
KAUSALYAGANGA, BHUBANESWAR 751 002, ORISSA, INDIA

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PREFACE

CorelDRAW is an intuitive graphics design application that gives designers an enjoyable work experience. The program is built to meet the demands of today's graphics professionals. Whether you work in advertising, printing, publishing, sign making, engraving, or manufacturing, CorelDRAW offers the tools you need to create accurate and creative vector illustrations and professional-looking page layouts.

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Dr A. E. Eknath
Director, CIFA

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EXECUTIVE SUMMARY

1. Name & address of the Institute
 - a) Headquarters
 - 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, Bangalore 560 089, Karnataka
 - iii) Regional Research Centre, Penamaluru Fish Seed Farm, Penamaluru, Vijayawada 521 139, Andhra Pradesh
 - b) Regional Centres
 - i) Regional Research Centre, Rahara Fish Farm, Rahara 743 186, West Bengal
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 - ii) Regional Research Centre, Hessarghatta Lake, Bangalore 560 089, Karnataka
 - iii) Regional Research Centre, Penamaluru Fish Seed Farm, Penamaluru, Vijayawada 521 139, Andhra Pradesh
 - c) KVK
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Central Institute of Freshwater Aquaculture,
Kausalyaganga, Bhubaneswar 751 002,
Orissa, India

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Penamaluru Fish Seed Farm, Penamaluru,
Vijayawada 521 139, Andhra Pradesh

Krishi Vigyan Kendra,
Kausalyaganga, Bhubaneswar 751 002,
Orissa



2. Budget (2007-08)

a) Institute (Rs in lakhs)

Plan		Non-Plan	
Provision	Expenditure	Provision	Expenditure
592.00	588.10	759.00	758.54

b) External sources (Rs in lakhs)

Source	Amount
BTIS	9.76
ICAR/AP Cess	36.17
Pension & Gratuity	78.59
ICAR/APA	1.90
ICAR National Fellow	9.28
P Loans & Advances	15.00
Total	150.70

c) Revenue generated (2007-08) (Rs in lakhs)

Farm produce	7.03
Sale of fish and poultry	7.24
Sale of vehicle/machine	0.68
Sale of publications	0.58
Licence fee/water charges	1.75
Analytical testing fee	0.20
Rent	0.48
Cost of tender forms	1.64
Services render	1.51
Training	11.18
Miscellaneous	3.96
Interest on loans and advances	7.15
Total:	43.40

3. Staff position (as on 31.3.2008)

Director	1
Principal Scientist	11
HoD	2
Senior Scientist	28
Scientist (SS)	5
Scientist	4
Technical Staff	54
Administrative Staff	40
Supporting Staff	128
Total	273

4. Research Projects

- a) Institute-based: 20
b) Externally-funded : 21

5. Training programmes conducted

Level	No. of programmes	No. of participants
National	11	274
International	03	30

6. Manpower development

- a) No. of persons trained at national level : 03
b) No. of persons trained at international level : Nil

7. Workshops organized

- National : 04
International : 02

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

Level	No. of participants
National	48
International	06

9. Infrastructure development

- ▶ Renovation of back sector ponds
- ▶ Hatchery facility for hormonal biotechnology study
- ▶ Installation of large glass aquaria tanks in Aquarium building
- ▶ Face lifting of Institute building and laboratories
- ▶ Medium and minor carp hatcheries
- ▶ Additional facility for seed rearing for carps, catfishes, ornamental fish and prawns
- ▶ Construction of Post-Graduate hostel
- ▶ Extension of health center building
- ▶ Maintenance of staff residential quarters

The following infrastructure was developed at RRC, Bangalore

- ▶ A new pipe line of 3" was laid to collect spent water from all the breeding and hatchery pools and convey the same to a 0.1ha grow-out pond and 0.01ha nursery pond, to enable economy of water use
- ▶ A percolation pit of 147 m³ and a canal of 0.5 m² cross-sectional area and 15 m length were excavated mechanically to collect and conserve the water discharged from 24 cemented nursery tanks. The pit is located in the natural rainwater runoff course of the farm and close to a bore well to aid in recharging of bore well by either source.
- ▶ A directly submersible sludge pump capable of pumping water with high-suspended solids was procured during the year, which has proved highly useful.

10. Salient Research Achievements

- ▶ Olive barb, *Puntius sarana* can be a viable alternative to mrigal in polyculture system. Rohu-gonius combination is more effective than mrigal-gonius
- ▶ Budgeting of carbon, nitrogen and phosphorus in carp and freshwater prawn culture ponds has been worked out

- ▶ A water budget model for freshwater aquaculture ponds is being developed, incorporating hydrological and physicochemical data
- ▶ Multiple breeding techniques have shown to enhance *Anabas testudineus* seed production
- ▶ A motor-driven mechanical fish-netting device for rectangular fish pond has been developed
- ▶ Over 82% survival was obtained during fingerling production of *Horabagrus brachysoma*
- ▶ Tagging of *Macrobrachium rosenbergii* with alpha numeric tags (VI Alpha) has been standardized
- ▶ Breeding and rearing of freshwater ornamental fish Melon barb (*Puntius fasciatus*) and Leopard danio (*Brachydanio frankei*) have been standardized
- ▶ An improved model of sand filter was developed for freshwater prawn hatchery
- ▶ Sixth generation of rohu selected for growth showed genetic gain of 17% over control
- ▶ In the challenge test against aeromoniasis, the resistant line of rohu showed 58.3% higher survival compared to the susceptible line
- ▶ Microsatellite genotyping of rohu has indicated a decrease in the number of alleles in the selected ones compared to farm controls
- ▶ Presence of PUFA-synthesizing enzymes in rohu has been confirmed
- ▶ Dietary fish meal can be completely replaced with fermented blood from slaughter house in yellow catfish without influencing growth and carcass composition
- ▶ Rohu and catla were bred during winter season and successfully produced seed for the first time in India under controlled conditions by manipulating environmental conditions
- ▶ TGF- was found to be a potential gene in fish to monitor environmental pollutants, particularly organophosphorus compounds
- ▶ Possibility of using food grade lactic acid bacteria as feed probiotic was observed
- ▶ Indian horseshoe crab haemolymph was shown to have antimicrobial properties in rohu
- ▶ High grade immune serum was prepared from *Puntius sarana*
- ▶ *Argulus* ingestion was shown to affect fish immune system, particularly in females
- ▶ Correspondence analysis on 38 nucleotide sequences including 24 ESTs (Expressed Sequence Tags) and 14 CDs (Coding Sequences) of rohu showed that the sequences were GC-rich
- ▶ Broostock development and breeding of *Ompok pabda* were successfully carried out at the Kalyani Field Station
- ▶ Manuring of culture ponds with biogas slurry resulted in 7 fold increase in the growth of Jayanti rohu within a culture period of 150 days at the Regional Research Centre, Vijayawada.
- ▶ Technical know-how on freshwater aquaculture was imparted to SC/ST farmers of Kendrapara and Keonjhar Districts of Orissa



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 mandate 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, Orissa 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

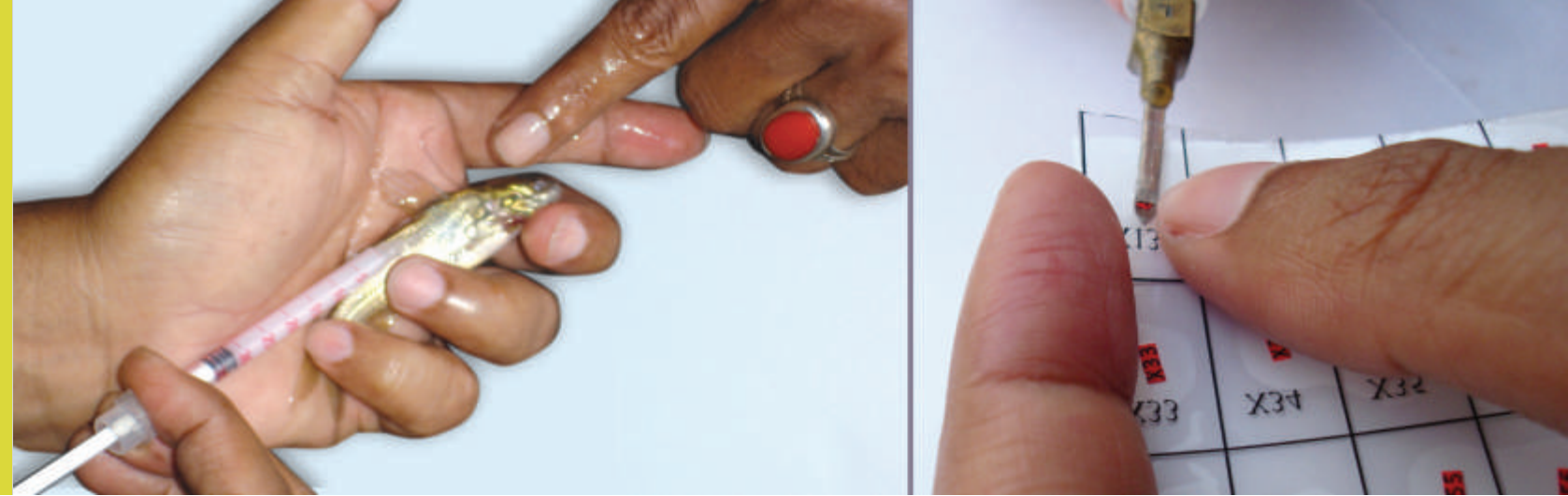
and the functional existence of the Institute came into effect from 1st April, 1987.

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, 10 km from the township of 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 three Regional Research Centres operating in different parts of the country to cater to the specific needs of the regions. These are: Regional Research Centre, Rahara (West Bengal), Regional Research Centre, Bangalore (Karnataka) and Regional Research Centre, Vijayawada (Andhra Pradesh).

The Institute is recognized as the Regional Lead Centre on Carp Farming under the Network of Aquaculture Centres in Asia-Pacific (NACA), which is now an intergovernmental organization. A Depository Library of the Food and Agricultural Organisation of the United Nations is also operational at the Institute.

CIFA ORGANOGRAM



RESEARCH ACCOMPLISHMENTS

A. Aquaculture Production and Environment

Project Title : Qualitative and quantitative assessment of gonad and gametes of Indian major carps through induced breeding with GnRH-based inducing agents and carp pituitary extract

Project Code : I-43

Duration : April 2004 - March 2008

Funding Agency : Institute-based

Project Personnel : P. Routray (PI), S. K. Sarkar, S. K. Sahoo, S. Adhikari, P. Swain, P. Das, Ashis Saha, S. Dasgupta and D. K. Verma

Comparative evaluation of breeding performance of rohu brood fish induced with

GnRH-based hormone (Ovaprim) and pituitary gland extract (PGE)

Evaluation of breeding performance of rohu was carried out four consecutive years starting from 2004. The experiments were carried out in the eco-hatchery system. The milt yield was found to be significantly higher in fishes induced with GnRH-based hormone. Similarly, the spermatocrit values and the sperm count were also higher in the fishes induced with Ovaprim over the four years of study (Table 1). However, the GSI of fishes bred with both types of inducing agents did not show any significant difference.

The data on recovery of egg and spawn/kg body weight obtained from fishes using different inducing agents are shown in Table 2. The recovery of eggs and spawn were higher in fishes that had been induced bred with GnRH-based hormone (Ovaprim) (Table 2, Fig. 1).

Table 1. Brood status (male) after hormone administration. Data shown as mean±SEM. Means having different superscripts differ significantly in a column (P<0.05)

Experiment Year	Inducing agents	Mean GSI(Jun-Aug) ±SD	Milt yield (ml/kg) ±SD	Spermatocrit % ±SD	Sperm count (X10 ⁷)
2004	PGE	0.7±0.15	3.8±2.3 ^a	58±2.6	2.2 ^a
	GnRH-based (Ovaprim)	0.6±0.24	5.9±1.8 ^b	59±2.0	2.9 ^b
2005	PGE	0.6±0.1	3.8 ±2.3 ^a	50±2.6	2.0 ^a
	GnRH-based (Ovaprim)	0.7±0.24	5.9 ±1.8 ^b	58±2.1	3.1 ^b
2006	PGE	0.7±0.15	3.5±2.5 ^a	58±2.6	2.4 ^a
	GnRH-based (Ovaprim)	0.6±0.24	5.0±1.8 ^b	59 ±2.0	2.9 ^a
2007	PGE	0.7±0.1	4.3±2.3 ^a	78±2.8	3.1 ^a
	GnRH-based (Ovaprim)	0.9±0.2	5.0±1.8 ^b	85±3.2	4.1 ^b

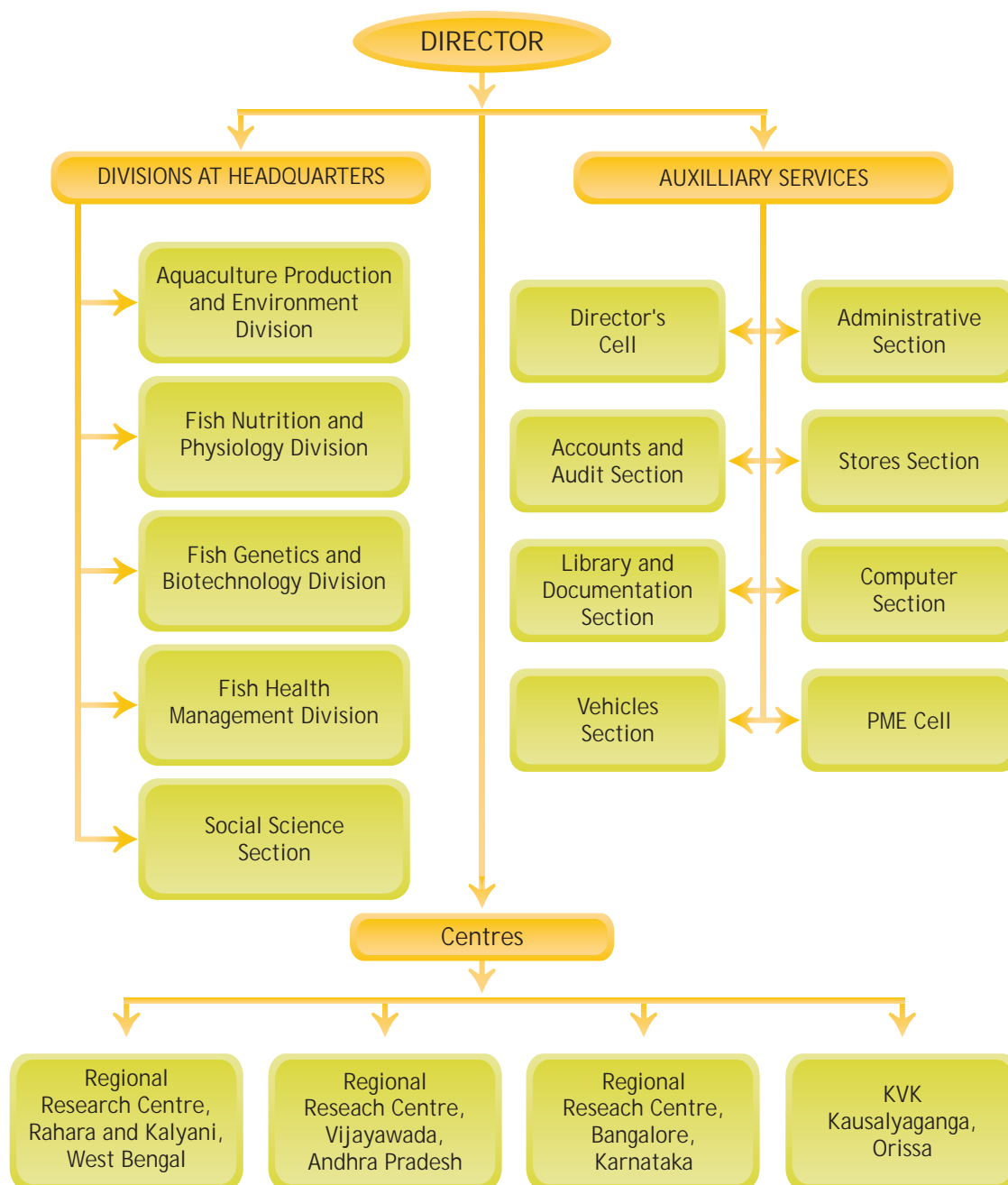


Table 2. Breeding performance of rohu brood fish (females) after induction of GnRH-based hormone (Ovaprim) and pituitary gland extract (PGE). Data shown as mean±SEM. Means having different superscripts differ significantly in a column (P<0.05)

Years	Inducing agents	No of fishes	Mean weight of female fish	Quantity of eggs/ Kg (x10 ⁵)	Fertilization %	Spawn recovery/kg (x10 ³)
2004	PG Extract	12	1.2	1.4 ^a	84	1.3 ^a
	GnRH-based (Ovaprim)	27	1.5	2.1 ^b	86	1.6 ^b
2005	PG Extract	20	1.7	1.9 ^a	90	1.4 ^a
	GnRH-based (Ovaprim)	32	1.6	2.1 ^b	88	1.8 ^b
2006	PG Extract	9	1.4	1.6 ^a	85	1.3 ^a
	GnRH-based (Ovaprim)	27	1.5	2.1 ^b	86	1.6 ^b
2007	PG Extract	20	1.3	2.3 ^a	90	1.8 ^a
	GnRH-based (Ovaprim)	20	1.4	2.9 ^b	95	2.6 ^b

Excel File Required

Fig 1. Breeding response (% of fishes bred) of rohu females after induction of GnRH-based hormone (Ovaprim) and pituitary gland extract (PGE). Data shown as mean±SEM. Bars having asterisks differ significantly within a year (P<0.05)

A significantly higher breeding response was observed in fishes bred with GnRH-based hormone in different years. This helps us to have an insight into the beneficial side of use of GnRH-based hormone in breeding operations of carps.

Project Title : Cryopreservation of primordial germ cells and embryonic cells of Indian major carps and their utilization in aquaculture biotechnology

Project Code : E-27

Duration : November 2004-February 2008

Funding Agency : ICARAP Cess Fund Scheme

Project Personnel : P. Routray (PI) and P. Swain

Toxicity and chilling sensitivity of early embryonic cells of rohu, *L. rohita* for development of a suitable cryopreservation protocol

Embryonic cells were isolated from different developmental stages of embryo of rohu starting from blastula (4, 8, 16, 32, 64 cell stage). Toxicity and chilling sensitivity to different cryoprotectants viz., DMSO, glycerol and 1, 2-propanediol, methanol (0.2 M, 0.5 M, 1.1 M, 1.4 M) were tested at different concentrations and temperatures (room temperature, 4 °C, 0 °C, and -10 °C at time intervals of 0, 15, 30, 60, 120 min). Maximum survival rate was observed in 1.4 M DMSO, so it was regarded as the best cryoprotectant for cryopreservation of embryonic cells of carps. The cryopreservation of embryonic cells in DMEM with cryoprotectant DMSO (1.4 M) with FBS 10% cooled at a rate of -1°C/min to -80°C and stored at liquid nitrogen temperature gave best results. Their post-thawing viability was more than 70%.

Localization of primordial germ cells (PGCs) in different developmental stages of rohu, *Labeo rohita* (Ham.)

A preliminary study was done to locate primordial germ cells of *Labeo rohita* and their migration pattern in the histological sections of different developmental stages. Germ cells were first detected at late morula stage (characterized by deep staining) and later on characterized by

larger faintly stained cells having a centrally placed nucleus. Migration starts from the posterior sides of morula stage to the ventero-lateral positions above the yolk syncytial layer (YSL) up to the tail bud stage and finally reaches the gonadal ridge (i.e., above the gut and in the sides of vertebral column). A schematic illustration of developmental stages showing possible PGC positions and migration pattern in carps is shown in Fig. 2.

Project Title : Evaluation of production performance of a few medium carp species under mono and polyculture systems

Project Code : E-25

Duration : May 2004-May 2007

Funding Agency : ICARAP Cess Fund

Project Personnel : J. K. Jena (PI), S. S. Giri and P. C. Das

Evaluation of growth performance and compatibility of *Puntius sarana* with major carps in polyculture system

Experiment on compatibility of olive barb, (*Puntius sarana*) in grow-out polyculture system was conducted in nine ponds of 0.08 ha each. The three treatments with different species combinations evaluated were T-1: catla, silver carp, rohu & sarana at the ratio of 0.5:0.5:1: 1; T-2: catla, silver carp, mrigal & sarana at 0.5:0.5:1:1 and T-3: catla, silver carp, rohu and mrigal at 0.5:0.5:1:1 at combined density of 7,500 fingerlings/ha.

The average harvested sizes of catla and silver carp were similar in the three treatments (P>0.05). Mrigal showed a significantly lower average body weight (ABW) in presence of rohu in T-1 compared to T-3 where rohu was absent (P<0.05). Similar lower ABW attainment (P<0.05) was also observed in olive barb in presence of rohu in T-2 compared to T-3 in presence of mrigal. Survivability of olive barb at 87.3-89.5% in the treatments was higher than those of rohu and mrigal. However, the level did not differ significantly in any of the species among its respective treatments (P>0.05).

The species-wise biomass production of silver carp, catla and rohu were similar in their respective treatments. Though there was significant variation in SGR and ABW of mrigal and olive barb in treatments, biomass production of mrigal was similar in T-1 and T-3, while that of olive barb in T-3 was higher than T-2 (P<0.05). The total biomass production in T-3 (3155.1±104.7

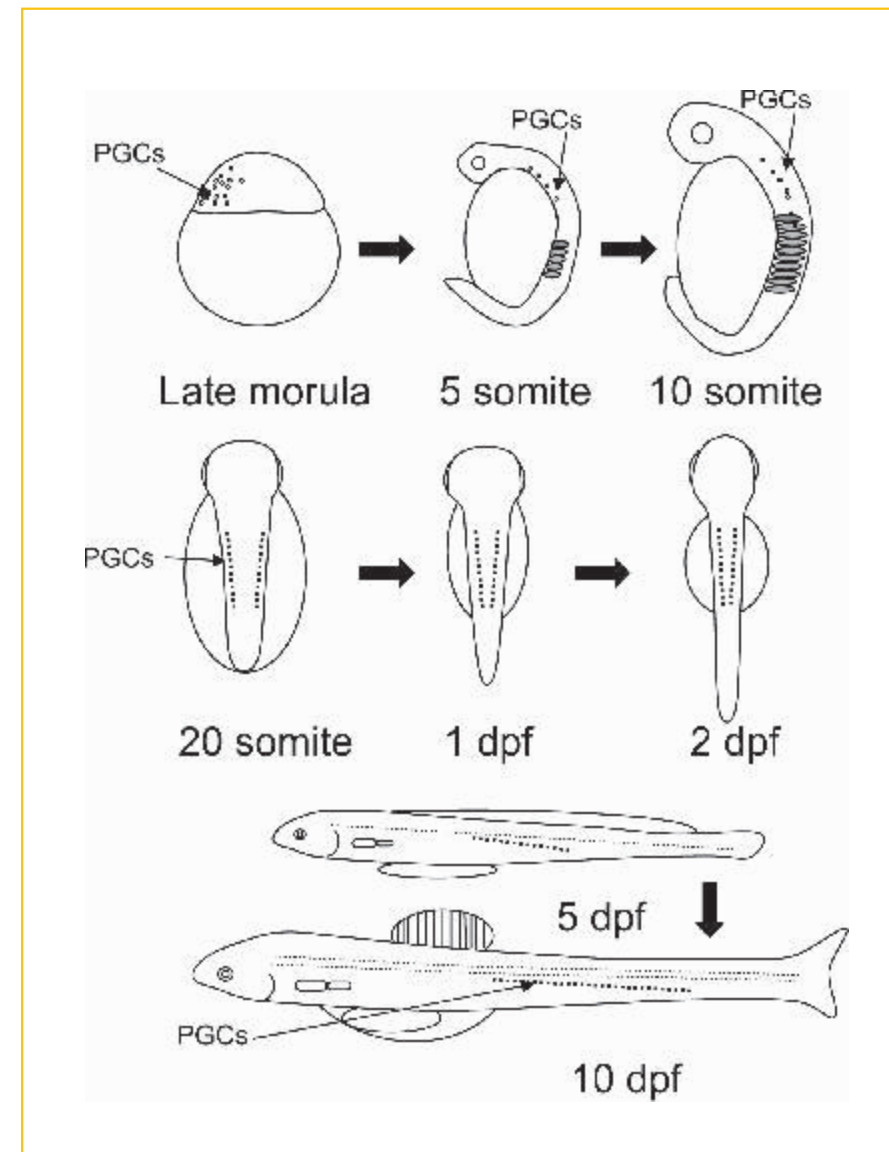


Fig. 2. Schematic illustrations of developmental stages showing possible PGC positions and migration pattern in carps. (dpf: days post fertilization)

kg/ha) in absence of rohu was significantly lower ($P<0.05$) than those of T-1 (3579.3±89.6 kg/ha) and T-2 (3418.4.3±95.0 kg/ha), and the latter two did not vary between themselves ($P>0.05$). Higher total biomass production in treatment having rohu and olive barb (T-2) compared to T-3 with mrigal and olive barb indicated potential of the species combination of T-2 over that of T-3 for grow-out polyculture. Advantage of culturing olive barb with rohu over that with mrigal was also supported by the significantly lower FCR in T-2 over T-3. Further, similar biomass production of T-2 with that of T-1 also indicated possibility of incorporating olive barb in place of mrigal in grow-out polyculture system without compromising the yield.

Evaluation of growth performance and compatibility of Labeo gonius with major carps in polyculture system

Grow-out polyculture experiment was carried out in nine ponds of 0.08 ha with different species combinations to study the compatibility of Labeo gonius with other major carps. The three treatments being evaluated were T-1: catla, silver carp, rohu and gonius; T-2: catla, silver carp, mrigal and gonius; and T-3: catla, silver carp, rohu and mrigal at combined density of 7,500 fingerlings/ha.

Comparison of yield attributes in the five carp species revealed silver carp to have significantly higher overall species survival ($P<0.05$), while catla showed the lowest level ($P<0.05$). Survivability of the other three species, i.e., rohu, mrigal and gonius were intermediate and did not differ among themselves. Though individual species did not show differential survival level in the treatments, T-2 with silver carp, catla, rohu and gonius combination showed higher levels than the other two. Growth performance of gonius in treatments T-2 and T-3 in absence of mrigal and rohu respectively, did not show any significant difference. Though the overall growth in T-1 (645.8±2 g) was significantly higher than that of T-2 (601.9±2 g), presence of gonius in place of mrigal in T-2 did not yield any significant

influence on overall production. The absence of rohu, the species with higher growth rate than that of mrigal caused a significantly lower overall growth in T-3. None of the individual species differed in its harvested size or SGR in treatments, but the overall SGR and harvested size in T-2 was intermediate between T-1 and T-3 ($P<0.05$).

The net biomass production in T-2 (3479.8±97.4 kg/ha) was similar to that of T-1 (3579.3±89.6 kg/ha), but significantly higher than that of T-3 (3085.7±115.0 kg/ha). Since performance of silver carp and catla were almost similar in all the three treatments attributed to less overlapping of their feeding niche with the other species, the higher net biomass yield in T-2 over T-3 revealed performance of rohu-gonius combination to be better than mrigal-gonius. Such results indicated stronger inter-specific competition between mrigal and gonius attributed to their bottom dwelling habit. Further, significantly higher net biomass gain of rohu in T-2 than that in T-1 revealed it to have better compatibility with gonius than with mrigal.

Exploring possibility of using *P. sarana* as a candidate for aquatic insect control

Microcosm experiment was conducted for 60 days in 30 l glass jars to evaluate the potential of *P. sarana* as a candidate species for control of aquatic insects. Five different types of feed or combination, i.e., live *Notonecta* (T-1), combination of live *Notonecta* and pelleted feed (T-2), dead *Notonecta* (T-3), only supplementary feed (T-4) and plankton concentrate from fish pond (T-5) were used in triplicated treatments. *Notonectids* were accepted well by fry of *P. sarana*. The overall average rates of consumption estimated at the end of study was highest in T-3 (17.83±1.85) followed by T-2 (16.04±2.28) and T-1 (13.81±2.26) ($P<0.05$). The fry showed significantly higher final body weight, net weight gain as well as specific growth rate with provision of live *notonectids* and supplementary feed combination (T-3) followed by T-2 and T-1 in that order (Fig. 3). Growth performances of the fry decreased significantly when fed with

supplementary feed (T-4) or plankton concentrate (T-3), but were almost similar in the latter two treatments ($P>0.05$). The study showed the feasibility of inclusion of the species for biological control of insects.

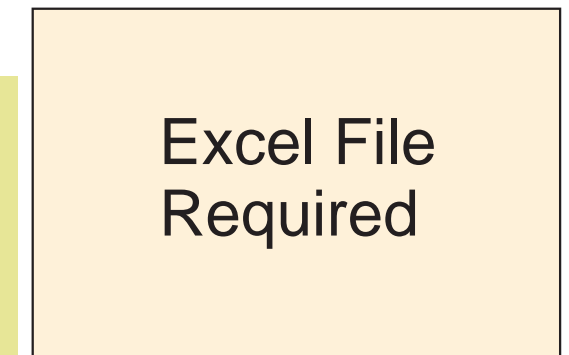


Fig. 3. The growth attributes of olive barb fed with notonectids plankton supplementary feed

Estimation of dietary protein requirement of *Puntius sarana* fingerlings

Sixty-day indoor feeding trial was conducted to study the effect of different dietary protein levels, i.e., 20, 25, 30, 35 & 40% as the five triplicated treatments on growth, feed utilization, tissue composition and protein requirement in fingerlings of *P. sarana*. Treatment T-3 with 30% protein showed the highest growth

among the treatments. The data were fitted to quadratic model and optimum protein requirement was estimated as 31.6%.

Project Title : Development of technology of seed production and culture of feather back, *Notopterus chitala* and two medium carps, *Labeo gonius* and *L. fimbriatus* for diversification of freshwater aquaculture

Project Code : E-32

Duration : January 2005-January 2010

Funding Agency : ICAR National Fellow Scheme

Project Personnel : J. K. Jena (PI)

Standardization of stocking density for nursery rearing of fringe lipped carp

The performance of *Labeo fimbriatus* in nursery rearing was evaluated in nine concrete tanks of 50 m² each (10 m x 5 m) at stocking densities of 8, 16 and 24 million spawn/ha as the three treatments T-1, T-2 and T-3 respectively, for a period of three weeks.

Table 3. Harvesting details of nursery rearing of *L. fimbriatus* at different stocking densities

Treatment	Replication	Survivability (%)	Size at harvest	
			Length (mm)	Weight (mg)
T-1	R1	46.7	23.9±1.3	157.3±22.4
	R2	59.2	22.8±1.5	130.2±40.8
	R3	44.9	24.1±2.5	149.5±40.7
	Mean	50.3±7.8 ^a	23.6±0.7 ^a	145.7±14.0 ^a
T-2	R1	45.4	19.4±1.7	87.3±11.6
	R2	52.3	21.8±0.8	121.2±11.1
	R3	40.0	21.9±1.0	128.4±16.9
	Mean	45.9±6.2 ^{ab}	21.0±1.4 ^b	112.3±21.9 ^b
T-3	R1	39.9	18.3±1.0	67.3±9.0
	R2	31.9	18.8±1.5	72.0±12.6
	R3	34.4	19.1±1.4	77.7±11.3
	Mean	35.4±4.1 ^b	18.7±0.4 ^c	72.3±5.2 ^c

Mean bearing different superscript differ significantly in a column ($P<0.05$); Values are expressed as mean±SD (n=3)

Performance of fry production in nursery was assessed through overall consideration of both survival and growth. Spawn reared at 8 million/ha density showed significantly higher growth in terms of both length and weight ($P<0.05$) followed by those at 16 and 24 million/ha ($P<0.05$) (Table 3). The survival levels at 8 million/ha density was significantly higher than that at 24 million/ha while level at 16 million/ha density did not differ significantly from either of the two. Rearing at 24 million/ha density though, did not yield a significantly different survival than 16 million/ha (considering the poor growth of the fry in the former within the stipulated period), such high density may not be recommended for concrete nursery as post-stocking mortality will be more due to smaller fry size. However, survival being the most important deciding factor in nursery rearing, the non-significant difference in the levels between 8 and 16 million/ha and the considerable intermediate fry size in the latter suggest feasibility of rearing up to a stocking density of 16 million/ha.

Evaluation of performance of fringe lipped carp in nursery rearing in treatments with and without soil base

Table 4. Harvesting attributes of nursery rearing of *L. fimbriatus* with and without soil base

Treatment	Replication	Survivability (%)	Size of harvest	
			Weight (mg)	Length (mm)
T-I (with soil base)	R-1	48.8	80.9±12.3	19.1±1.0
	R-2	56.1	82.4±10.0	19.0±1.2
	R-3	47.8	98.7±11.9	19.8±1.3
	Mean	50.9±4.5 ^a	87.3±9.9 ^b	19.3±0.4 ^b
T-II (without soil base)	R-1	33.5	171.2±25.6	24.9±1.3
	R-2	31.9	177.6±25.8	25.0±1.6
	R-3	28.8	175.6±16.2	25.2±1.1
	Mean	31.4±2.4 ^b	174.8±3.3 ^a	25.0±0.2 ^a

Mean bearing different superscript differ significantly in a column ($P<0.05$); Values are expressed as mean±SD (n=3)

The benefit of providing soil base in concrete nursery for seed rearing of *L. fimbriatus* was evaluated in six concrete tanks of 50 m² each (10 m x 5 m). Of the two triplicate treatments, while tanks in T-1 were provided with 15 cm soil base, no

soil was added in tanks of T-2. All tanks were provided with filtered pond water and supplemental feed and were stocked with spawn of *L. fimbriatus* at 16 million/ha density.

Provision of soil base in the concrete nursery tanks (T-1) yielded significantly higher survival over the tanks without soil base (T-2) ($P<0.05$) (Table 4). However, the growth performance of fry measured in terms of both length and average body weight were significantly higher in T-2 than T-1 ($P<0.05$), attributed to the significantly lower survival in the former. Since survival is the most important deciding factor in nursery rearing, the result of the study suggest providing soil base in concrete nursery to be a better option for effective seed rearing.

Nursery rearing of *Labeo gonius* at varied stocking densities

Nursery rearing of *Labeo gonius* was carried out for three weeks in outdoor concrete tanks of 50 m² each (10 m x 5 m) at two densities, viz., 8 and 16 million/ha in triplicate as T-1 and T-2 respectively. The pre- and post-stocking management of the experimental tanks were similar to that of the previous nursery rearing trial.

5). Despite the stocking density in T-2 being two times higher than T-1, similar survival denoted possibility of rearing up to 16 million/ha density. However, the lower harvest size of the fry at 16 million/ha ($P<0.05$) also indicated possibility of higher post-stocking mortality. Therefore, density at 8 million/ha may be recommended for effective fry rearing of *L. gonius* in concrete nursery.

Labeo fimbriatus at different levels of incorporation with rohu during raising of fry to fingerlings. The experiment was conducted for a period of two months. The four treatments evaluated based on stocking ratios of fringe lipped carp and rohu at 25 & 75% (T-1), 50 and 50% (T-2), 75 & 25% (T-3), while 100% fringe lipped carp served as T-4. The tanks were provided with soil base and filled with filtered pond water. No basal fertilization was undertaken. All the tanks were

Table 5. Stocking and harvesting details of nursery rearing of *L. gonius* at different stocking densities

Treatment	Replication	Survivability (%)	Size at harvest	
			Length (mm)	Weight (mg)
T-1	R1	35.5	23.1±2.4	167.0±49.6
	R2	33.8	24.6±3.6	183.8±58.1
	R3	44.5	21.6±2.6	120.9±52.9
	Mean	37.9±5.8 ^a	23.1±1.5 ^a	157.2±32.6 ^a
T-2	R1	32.8	18.1±1.8	72.1±19.6
	R2	24.6	18.9±1.3	80.0±7.4
	R3	27.4	17.9±1.5	70.2±10.1
	Mean	28.3±4.2 ^a	18.3±0.5 ^b	74.1±5.2 ^b

Mean bearing different superscript differ significantly in a column ($P<0.05$); Values are expressed as mean±SD (n=3)

Evaluation of performance of fringe lipped carp during fingerling rearing under polyculture with rohu

Experiment was conducted in outdoor concrete tanks of 50 m² each (10 m x 5 m) to evaluate relative growth performance of fringe lipped carp

stocked at density of 2.0 lakh/ha. The mean size of stocking was 0.42±0.23 g and 0.55±0.21 g for rohu and fringe lipped carp, respectively. Post-stocking management included fertilization of ponds and supplemental feeding. Details of the yield attributes are presented in Table 6.

Table 6. Harvesting details of fingerlings rearing of *L. fimbriatus* with rohu at different stocking ratios

Treatment	Species	Survivability (%)	Size at harvest	
			Length (mm)	Weight (mg)
T-1	<i>L. rohita</i>	89.6 ^a	7.1 ^b	3.94 ^b
	<i>L. fimbriatus</i>	85.6 ^{ab}	8.4 ^a	5.66 ^a
	Mean	87.6±4.2 ^{ab}	7.8±0.1 ^{ab}	4.80±0.97 ^a
T-2	<i>L. rohita</i>	87.6 ^a	7.0 ^b	4.35 ^b
	<i>L. fimbriatus</i>	83.7 ^b	8.0 ^b	5.10 ^b
	Mean	85.9±4.5 ^{ab}	7.5±0.6 ^b	4.72±0.45 ^a
T-3	<i>L. rohita</i>	89.1 ^a	8.0 ^a	5.18 ^a
	<i>L. fimbriatus</i>	89.2 ^a	8.1 ^b	4.85 ^b
	Mean	89.2±2.9 ^a	8.1±0.2 ^a	5.01±0.45 ^a
T-4	<i>L. fimbriatus</i>	82.8±2.5 ^b	7.7±0.1 ^c	4.26±0.14 ^b

Mean bearing different superscript differ significantly for a particular species or mean values in a column ($P<0.05$); Values are expressed as mean±SD (n=3)

Varied species composition of rohu and fringe lipped carp did not yield any significant variation in either species survival among the treatments or the mean treatment survival among T-1, T-2 and T-3. The T-4 treatment with 100% fringe lipped carp showed a significantly lower survival as well as growth performance than that in other treatments (Table 6), attributed to the possible intra-specific competition. Among the treatments, both length and weight attainment in the two species showed an inverse relationship with their stocking ratio. When all the data in T-1, T-2 and T-3 were pooled together to compare the performance of the two species, growth performance (both length and weight) of fringe lipped carp was better than that of rohu while survival of rohu was higher.

While similar survival level in both species in T-1, T-2 and T-3 revealed compatibility between rohu and fringe lipped carp, the inverse relationship between growth performance (length and weight) with the stock composition ($P < 0.05$) indicated intra-specific competition, rather than inter-specific one, to affect their growth performance during fingerling rearing.

Evaluation of duration of aeration in fingerling rearing of *L. fimbriatus* in polyculture system

Experiment was carried out in 12 concrete tanks of 50 m² (10 m x 5 m) each to evaluate the impact of different aeration hours on survival and growth performance of *Labeo fimbriatus* reared under polyculture system with catla, rohu and olive barb (*Puntius sarana*) for a period of 90 days. The experimental design consisted four treatments, each having three randomly assigned replications. Night time aeration with the use of air blower for varied duration, i.e. 4 hours (02.00-06.00 h), 8 hours (22.00-06.00 h) and 12 hours (18.00-06.00 h) were assigned as the three treatments T-I, T-II and T-III respectively and were evaluated against the control T-c with no aeration (0 hour). All the experimental tanks were provided with soil base of 15 cm depth. The tanks were stocked at a combined density of 50 fry/m² (5 lakh/ha) in the ratio of 1:2:1:1. Fertilization and supplementary feeding was provided at conventional doses.

The important hydro-biological parameters were within the optimum ranges and were almost similar ($P > 0.05$) among the treatments except significantly higher dissolved oxygen in aerated treatments. Overall survival and net biomass of the species increased among the treatments significantly as a function of aeration hours (T-c < T-I < T-II < T-III) (Table 7). While the survival of fishes in T-II (73.6±5.8) and T-III (81.8±2.7%) were almost similar, both were significantly higher than that of T-I (57.7±7.8%) ($P < 0.05$) (Table 7). Tanks aerated for 8 and 12 hours in T-II and T-III, respectively showed significantly higher performance in all the carps than the groups aerated for 4 hours (T-I), indicating requirement of 8-12 hours of night aeration for better survival.

In general, the overall harvest size of the species among the treatments was significantly higher ($P < 0.05$) in T-III (7.15±0.31 g), followed by T-II (6.15±0.45 g), while size of T-I and T-c were significantly lower ($P > 0.05$). The overall net biomass of the species among the treatments increased significantly as a function of aeration hours. The maximum net biomass was produced in T-III followed by T-II, T-I and T-c. Among the species, while the biomass production in catla, rohu and sarana increased significantly with increasing aeration hours, fringe lipped carp did not show any significant difference ($P > 0.05$) in biomass production when provided with 4 and 8 hours of aeration.

Although T-II and T-III registered statistically similar survival, harvested body weight and SGR, the relatively better performance of fishes in all these three attributes led to significantly higher net biomass production (23.3%) in T-III over T-II. Such results indicated 12 hours of aeration to have an edge over the eight hours. Species-wise performance showed 8-12 hour aeration to be advantageous for catla and rohu, but night aeration for 4 hours was adequate for fringe lipped carp and olive barb. However, the significantly lower net biomass in T-I among the aerated groups (27.9 and 41.5% lower net biomass than T-II and T-III, respectively) corroborated four hours of night aeration to be insufficient for yielding optimum growth in these carps as well as in the overall carp fingerling production under polyculture system.

Table 7. Stocking and harvesting attributes of carp under varied aeration hours in raising fingerlings

Treatment	Species	Harvested size (g)	Survivability %	Net biomass (kg)	SGR (%/day)
T-C	Catla	8.67±0.15 ^b	17.7±2.6 ^c	0.72±0.10 ^d	3.17±0.02 ^b
	Rohu	4.73±0.15 ^b	35.0±6.3 ^c	1.52±0.26 ^d	2.74±0.04 ^b
	Fimbriatus	4.53±0.12 ^b	28.0±2.1 ^c	0.61±0.05 ^c	3.46±0.03 ^b
	Sarana	4.60±0.26 ^b	28.9±2.4 ^c	0.58±0.02 ^d	2.26±0.06 ^b
	Total/Average	5.63±0.09 ^b	28.9±2.6 ^c	3.77±0.40 ^d	2.91±0.02 ^c
T-I	Catla	8.80±1.15 ^b	42.8±10.5 ^b	1.74±0.23 ^c	3.18±0.14 ^b
	Rohu	5.37±0.57 ^b	59.9±9.0 ^b	2.94±0.15 ^c	2.88±0.12 ^a
	Fimbriatus	5.03±0.31 ^{ab}	61.5±4.7 ^b	1.50±0.18 ^b	3.58±0.07 ^{ab}
	Sarana	5.07±1.44 ^{ab}	64.2±11.8 ^b	1.39±0.27 ^c	2.34±0.30 ^{ab}
	Total/Average	6.08±0.86 ^b	57.7±7.8 ^b	8.04±0.43 ^c	2.99±0.15 ^{bc}
T-II	Catla	9.27±1.00 ^{ab}	60.3±4.8 ^a	2.62±0.09 ^b	3.24±0.12 ^{ab}
	Rohu	5.80±0.17 ^a	74.7±3.5 ^a	4.03±0.14 ^b	2.97±0.03 ^a
	Fimbriatus	5.03±0.40 ^{ab}	75.3±7.1 ^a	1.83±0.31 ^{ab}	3.59±0.09 ^{ab}
	Sarana	5.93±0.95 ^{ab}	83.0±10.9 ^a	2.18±0.08 ^b	2.53±0.17 ^{ab}
	Total/Average	6.51±0.45 ^{ab}	73.6±5.8 ^a	11.15±0.24 ^b	3.08±0.06 ^{ab}
T-III	Catla	10.43±0.32 ^a	62.6±3.0 ^a	3.11±0.07 ^a	3.37±0.03 ^a
	Rohu	5.97±0.15 ^a	85.90±4.2 ^a	4.78±0.21 ^a	3.01±0.03 ^a
	Fimbriatus	5.53±0.68 ^a	84.4±5.2 ^a	2.26±0.37 ^a	3.68±0.13 ^a
	Sarana	6.6±0.45 ^a	90.33±1.6 ^a	2.74±0.23 ^a	2.67±0.08 ^a
	Total/Average	7.15±0.31 ^a	81.8±2.7 ^a	13.75±0.73 ^a	3.18±0.05 ^a

Values are expressed as Mean±SD (n=3); For each species, values with same superscript in a column do not differ significantly ($P < 0.05$), (n=3)

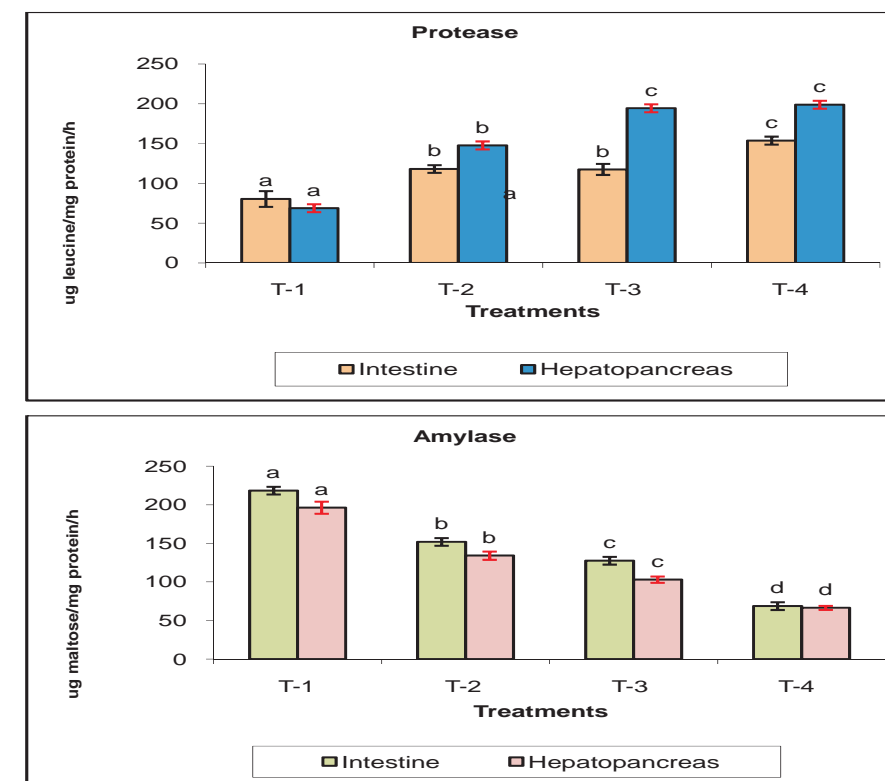


Fig. 4. Variation of digestive enzyme activity in *L. gonius* fingerlings fed varying levels of protein diets

Evaluation of the optimum dietary protein requirement of *Labeo fimbriatus*

A sixty days indoor feeding trial was carried out to evaluate the optimum protein requirement of *Labeo fimbriatus*. Five treatments with different protein levels, i.e. 20, 25, 30, 35 & 40% in the supplementary feed were evaluated in triplicates. Carps optimum protein requirement was estimated to be 30.34% for *L. fimbriatus*.

Study of digestive enzymes activity and digestibility in *L. gonius* fed varying protein diets

Amylase and protein activities of *L. gonius* individual treated with 20(T-1), 25(T-2), 30(T-3) and 35%(T-4) dietary protein levels were measured. Intestine and liver collected from four specimens from each tank were used for the assay.

Protease activity (Fig. 4) increased significantly ($P < 0.05$) in intestine with increasing dietary protein levels having highest value in T-4 group whereas in hepatopancreas, it increased with increasing dietary protein levels to a maximum up

to 30% protein level. At higher dietary protein levels no significant changes ($P>0.05$) in the activity was observed. A correlation ($r_i=0.90$; $r_h=0.90$) between the protein content of the diet and protease activities could be found in the present study. However, an inverse relationship between amylase activities (Fig. 5) and protein content in the diet has been observed with highest activity in low protein diet (F-1, crude protein content of 20.6%) and lowest activity in high protein diet (F-4, crude protein content of 33.9%) respectively. Amylase: protein (A/P) ratio (sum of intestine and hepatopancreas) varied significantly ($P<0.05$) among groups showing significantly highest value (5.72) in T-1 group and lowest (0.78) in T-4 group (Fig. 5).

Among the apparent digestibility coefficients for protein, lipid and energy for all experimental diets, APD (Apparent Protein Digestibility) did not vary significantly ($P>0.05$) between the experimental groups despite different protein levels in the diets, whereas, AED (Apparent Energy Digestibility) differed significantly ($P<0.05$) among the groups showing highest value in T-4 and lowest in T-1 group (Table 8). However, ALD (Apparent Lipid Digestibility) in T-3 and T-4 groups were significantly different ($P<0.05$) with that of T-1 and T-2 groups having highest value in T-4 groups and lowest value in T-1 group.

Table 8. Apparent nutrient digestibility coefficient (%) in *L. gonius* fingerlings fed varying protein diets

Nutritional Indices	Experimental Diets			
	T-1	T-2	T-3	T-4
Apparent protein digestibility (APD)	92.36 ±2.84 ^a	94.66 ±1.49 ^a	93.69 ±0.41 ^a	93.86 ±0.21 ^a
Apparent lipid digestibility (ALD)	85.21 ±1.86 ^b	85.94 ±1.19 ^b	92.22 ±2.12 ^a	93.7 ±0.495 ^a
Apparent energy digestibility (AED)	44.31 ±0.32 ^d	51.37 ±0.26 ^c	62.86 ±0.72 ^b	72.06 ±0.02 ^a

Values (mean±SD) with same superscript in a row do not differ significantly ($P>0.05$, $n=4$)

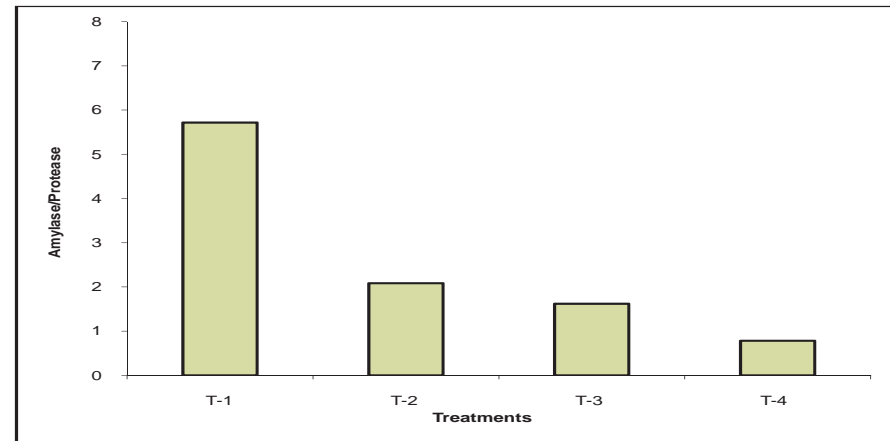


Fig. 5. Ratio of total amylase and total protease activity in the gut of *L. gonius* fingerlings fed varying levels of protein diets

Project Title : Development of protocol for organic farming of carps and freshwater prawns
Project Code : E-34
Duration : August 2005-August 2008
Funding Agency : ICARAP Cess Fund Scheme
Project Personnel : J. K. Jena (PI), S. Adhikari, Bindu R. Pillai and P. C. Das

Evaluation of toxicity levels of cube root powder as organic piscicide in a few common freshwater predatory and weed fishes

Toxicity of cube root powder containing rotenone was studied in a few common freshwater predatory and weed fish (*P. sophore*, *C. orientalis*, *A. testudineus*, *H. fossilis* and *C. punctatus*) through wet laboratory experiments for its use as a piscicide during pond preparation. Cube root powder (CRP) (ENT-133 Rotenone) containing 9% rotenone was used as the toxicant source.

Range finding tests were followed by tests of acute toxicity for four species namely *P. sophore*, *C. punctatus*, *A. testudineus* and *H. fossilis*. These tests were conducted for 72 hours under static condition with the

experimental set up similar to the former, but with varied treatment concentrations based on the identified safe (0% mortality) and lethal (100% mortality) ranges for respective species.

Lethal concentration of CRP for these common weed and predatory fishes varied between 0.75-2.70 mg/l (0.068-0.243 mg/l of rotenone). Acute toxicity study revealed *Puntius sophore* to have more susceptibility to rotenone toxicity with 24-h LC_{50} value of CRP at 0.50 mg/l (0.045 mg/l rotenone) compared to 1.17 mg/l (0.105 mg/l rotenone) in *Anabas testudineus* and 1.90 mg/l in *Channa punctatus* (0.171 mg/l rotenone), while *Heteropneustes fossilis* showed higher tolerance with 24-h LC_{50} value at 2.42 mg/l (0.218 mg/l rotenone). Such results suggested rotenone toxicity to depend on the respiratory behaviour of fish. The marginal reduction in 48-h LC_{50} of CRP compared to its 24-h value and no fish mortality beyond 48-h in all tested species suggested faster degradation of the toxicant in water. Since application of the piscicide aims at eradication of all commonly available species of weed and predatory fishes in the culture pond, the study suggested a dose of 2.5 mg/l of CRP (0.225 mg/l rotenone) for pond application.

Use of Rotenone powder as piscicide vis-à-vis mahua (*Basia latifolia*) oilcake and bleaching powder and their impact on the pond environment

Studies were carried out to evaluate the efficacy of cube root powder (rotenone) as an alternative piscicide for eradication of predatory and weed fishes during pre-stocking pond preparation. *Puntius sophore*, *Channa punctatus* and *Anabas testudineus* were exposed to 215 mg/l cube root powder (rotenone), 250 mg/l mahua oil cake and 35 mg/l bleaching powder. All challenged fishes died irrespective of the toxicants, within 18 hr of the application of the piscicides.

Further, effective fish kill capability of cube root powder at 2.5 mg/l was evaluated in field condition against bleaching powder (35 mg/l). Mortality in small weed fishes and Indian major carps was observed within 2 hr of application of

both CRP and BP while catfishes exhibited greater tolerance to rotenone toxicity. With CRP, 100% survival of carp fingerling and fry were ensured on 8th and 11th day post-application against 4th day with bleaching powder. Zooplankton population was grossly affected with CRP and BP while only 60% reduction was observed following application of MOC. The CRP application did not affect the concentrations of chlorophyll a, b or c; in contrast to the gross effect observed with BP application. The BP application also caused 88% reduction in zooplankton density in pond against 70% in CRP. Original zooplankton density was regained in pond on 12th day with CRP application, while same could not be achieved in BP application even after 20th day. The study revealed advantageous of pond application of CRP as piscicide over bleaching powder for growth of fish food organisms.

Project Title : Diversification in freshwater aquaculture for sustainable production
Funding Agency : Institute-based
Sub-project : Nutrient budgets in freshwater fish pond
Project Code : I-54(a)
Duration : April 2006-March 2009
Project Personnel : S. Adhikari (PI), J. K. Jena, B. R. Pillai, P. C. Das, K. C. Pani and B. Mishra

Preparation of budget for carbon, nitrogen and phosphorus in carp culture ponds

Experiments were conducted to study the nutrient budget in three 0.5 ha farmers' ponds in Orissa with a mean water depth of 1.5 m. Fingerlings of *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* were stocked in these ponds at a ratio of 4:3:3 with a stocking density of 8000/ha. There was average weight of 70-80 fold in these species at the end of one year culture period. The budget showed that fertilizers, feed and manure were the major inputs of nitrogen, phosphorus and carbon in the ponds. Inlet water, either from the initial fills or from rainwater was the source of all other nitrogen, phosphorus and carbon to

these ponds. These, harvest of fish accounted for recovery of 34% of nitrogen, 12% of phosphorus and 22% of carbon, respectively added to the culture system.

Carbon, nitrogen and phosphorus budget in freshwater prawn culture ponds

Nutrient budget was studied in freshwater prawn *Macrobrachium rosenbergii* culture ponds having 200 m² water area. Results of the nutrient analysis indicated that 27-32% of the nitrogen composition of feed was converted into prawn growth. The rate of phosphorus composition of feed was 20-23% converted into prawn growth while the rate of carbon composition of feed was 08-15% converted into prawn growth.

Budgeting of carbon, nitrogen and phosphorus in spawn and fry rearing of carps under different management practices

Study was conducted in five 0.01 ha farmers' ponds in Orissa with a mean water depth of 1.5 m for the budget of carbon, nitrogen and phosphorus in spawn rearing of carps for 21 days. Three days old spawn of *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* were stocked individually in these ponds. At the end of the one year culture period thus was a significant weight going over 700 fold in these species. The average survival rate was 30%. Harvest of fry recovered 85% of added nitrogen, 47% of added phosphorus and 66% of added carbon from these ponds.

Effect of arsenic on prawn growth

An experiment was conducted to study the effect of arsenic (As III) on survival rate, growth and feed intake of Indian river prawn *Macrobrachium malcolmsonii* exposed to different concentrations of arsenic (control, 0.10, 0.25, 0.50 and 0.75 mg/l) for 45 days under laboratory conditions. The study showed that level of As (III) influences the survival, growth and feed intake of the prawn. Mortality of juveniles (6.07±1.2 g) increased with increasing arsenic concentrations. As III had a significant (P<0.05) effect on prawn growth as the prawns grew faster in control compared to 0.50 and 0.75 mg/l of arsenic at temperature 26±2.5°C,

pH 7.3±0.1 and hardness 106±4 mg/l as CaCO₃. Average daily growth was 0.037±0.007, 0.033±0.004, 0.030±0.002, 0.014±0.004 and 0.010±0.006 g/day at the five respective concentrations of arsenic. No significant differences (p>0.05) in prawn growth could be observed between 0.5 and 0.75 mg/l of arsenic levels. Also, no significant differences (p>0.05) in prawn growth were noted among control, 0.10 and 0.25 mg/l of arsenic levels. Feed intake in experimental prawns increased in the 0.25 mg/l of arsenic level compared with 0.50 and 0.75 mg/l levels and it ranged from 3.06±0.24% body weight in control to 2.48±0.22% at the 0.75 mg/l of arsenic levels. Significant differences (p<0.05) in feed intake were observed due to higher level of arsenic exposure.

Effect of zinc on fish growth

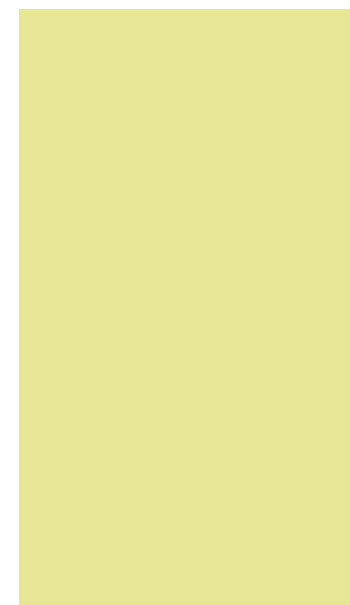
An experiment was conducted to study the effect of zinc on survival, growth and feeding of Indian major carp *Cirrhinus mrigala* (Hamilton) advanced fry under laboratory conditions. Survivability rates of *Cirrhinus mrigala* advanced fry (2.71±0.49 g) following 30 days exposure to control, 0.05, 0.10, 0.20 and 0.30 mg/l zinc using the static renewal method in freshwater (at pH 7.3±0.2, temperature 26±2°C and total hardness 114±16 mg/l as CaCO₃) were hundred percent. Growth of the fish exposed to 0.20 and 0.30 mg/l zinc was significantly lower (P<0.05) than in control, 0.05 and 0.10 mg/l zinc after 30 days of exposure. However, there were no significant differences (P>0.05) in fish growth between 0.05 and 0.10 mg/l zinc concentrations. Feed intake rates were significantly (P<0.05) reduced in the fishes exposed to 0.20 mg/l and higher levels of zinc. The present study showed a significant (P<0.05) variation in the concentration of zinc in the fish. Accumulation of zinc in the fish increased proportionately with the increase in treatment levels.

Effect of copper on fish growth

An experiment was conducted to study the effect of copper on survival, growth and feeding of Indian major carp *Cirrhinus mrigala* (Hamilton)



Cage aquaculture in CIFA Farm



fingerlings. Survivability rates of *C. mrigala* fingerlings (6.02±0.42 g) following 60 days exposure to control, 0.10, 0.15 and 0.25 mg/l of total copper (Cu) were 100, 83, 58 and 50%, respectively. Average daily growth of the fish was significantly (P<0.05) lower at 0.15 mg/l and higher level of total copper compared to control. Feed utilization was significantly (P<0.05) reduced in *C. mrigala* fingerlings exposed to 0.15 mg/l and higher level of copper. Copper accumulation in the fish body parts increased with increasing concentrations of the metal.

Sub-project : Cage aquaculture and its impact on the ecosystem

Project Code : I-54(b)

Duration : April 2006- March 2008

Project Personnel : P. Kumaraiah (PI till 3 October, 2007), D. N. Chattopadhyay (PI w.e.f. 4 October, 2007), B. C. Mohapatra, S. Adhikari, K.C. Pani and S. K. Singh

Cage culture in CIFA campus

Two sets of cage culture experiments were carried out in 11 cages of 10 m² each in Reservoir-2 (2 ha) in CIFA viz. Experiment -I (6 months; rohu, catla and mrigal) and Experiment -II (3 months; rohu and koi carp). In both the experiments fish were fed with artificial feeds (rice polish and GNOC in 1:1 ratio) in submerged trays.

In Experiment-I, the survival, average size and production of rohu and mrigal in mono-culture and catla and mrigal in bi-species culture were 66.16%, 44.5%, 33.66%, 24.66%; 188.32 mm/99.92 g, 122.33 mm/83.03 g, 210 mm/126.48 g, 212.94 mm/102.35 g, and 3.119, 1.174, 0.804 and 0.604 kg/m²/yr, respectively.

In Experiment -II, the survival, average size and production of rohu in mono-culture and rohu and koi carp in bi-species culture were 64.83%, 22.33%, 41.66%; 135.72 mm/30.48 g, 201.35 mm/114.28 g, 103.33 mm/18.88 g, and 3.036, 2.09, 0.482 kg/m²/yr, respectively.

Increase of cage culture area (0.55%) from the last year (0.3%) did not influence the environmental parameters. Although there were significant increase in NH₄-N and CO₂ and decrease in alkalinity of water in cage area, the levels were non-toxic. The cage area can be increased further to study the impact on the ecosystem

Cage culture in Kuanria reservoir at Daspalla (Nayagarh district)

The Institute in coordination with Orissa State Fisheries Department has initiated a cage culture demonstration programme in Kuanria reservoir (FRL 200 ha) near Daspalla in Nayagarh District. Six cages (each of 10 m² area) were installed and stocked with rohu. A Cooperative Society in Odasa Village, located near the reservoir, did routine management of the cages. The survival (%), production and average size of rohu fingerlings at time of harvest (120 days culture period) was 95.16%, 3.05 kg/m²/year and 125.62 mm/21.4 g, respectively. More than 100 farmers participated in this demonstration programme.



Cage aquaculture in Kuanria Reservoir

Sub-project : Water budget modeling of freshwater fish pond under warm and humid climate

Project Code : I-54(c)

Duration : April 2006 - March 2009

Project Personnel : K. K. Sharma (PI), B. C. Mohapatra, P. C. Das, S. Chand and B. Sarkar

Observations

Hydrological data viz., ambient air temperature, relative humidity, water temperature, water level, rainfall, pan evaporation, seepage, run-off, in-flow and out-flow were collected on daily basis using different instruments installed inside and outside the experimental ponds. Similarly physiochemical parameters at the experimental ponds were analysed on weekly basis.

Analysis of data

The daily-recorded and weekly-recorded data on hydrological and physiochemical parameters respectively were analyzed to have mean monthly data for model development. The results are given in Tables 9 & 10, respectively.

Table 9. Mean monthly data of environmental parameters and pond water temperature at experimental site

Month	Ambient air (°C)	Relative humidity (%)	Pond water temp. (°C)	Rainfall (mm)
Apr.	25.70±0.75-36.73±1.46	57.46±4.99-94.00±2.00	29.27±1.05	0.87±4.06
May	26.39±1.31-37.19±2.67	57.13±4.24-96.97±1.80	30.61±1.71	4.75±12.92
Jun.	26.03±1.49-35.57±2.95	57.90±5.20-96.10±2.12	30.20±1.37	13.13±27.56
Jul.	25.55±1.34-33.52±1.24	59.32±2.61-97.48±0.91	30.45±1.10	8.10±14.81
Aug.	24.94±1.27-31.19±2.21	61.32±5.99-98.23±0.83	30.29±2.00	18.58±43.50
Sep.	25.63±0.63-31.21±1.99	64±2.96-96.16±3.69	29.68±1.74	9.00±11.52
Oct.	22.10±2.52-31.96±1.89	58.55±5.31-91.94±2.77	29.57±0.98	2.65±5.50
Nov.	18.59±2.97-30.44±1.85	48.97±5.59-88.63±2.63	27.62±3.69	0.40±1.52
Dec.	13.77±1.69-28.22±1.19	44.32±3.53-83.58±2.25	21.05±1.65	Nil
Jan.	15.04±1.92-29.95±1.68	49.71±6.03-87.58±3.42	23.03±1.73	1.06±4.06

Table 10. Mean monthly hydrological and water budget data of experimental ponds

Months	Water gain (rain +run-off + ground inflow) (mm)	Pond evaporation (mm)	Seepage (mm)	Water addition (m ³)
April	4.06±0.87	17.13±4.06	9.62±12.86	27.64
May	4.75±12.92	19.30±8.05	6.25±3.06	25.33
June	13.13±27.56	13.68±2.55	4.25±2.06	5.85
July	8.10±14.81	2.04±1.09	2.26±2.42	(-) 4.63
Aug.	11.12±2.87	1.29±0.82	1.79±2.64	(-) 9.79
Sept.	9.00±11.52	1.56±0.91	11.43±14.95	4.86
Oct.	2.65±5.50	2.57±2.36	17.07±8.35	20.69
Nov.	0.40±1.52	7.96±4.49	2.27±1.76	11.97
Dec.	Nil	8.58±15.49	3.78±2.57	15.05
Jan.	23.03±1.73	4.11±0.60	15.71±7.20	3.91

* Negative values indicates water gain

Sub-project : Farming of freshwater climbing perch, *Anabas testudineus* (Bloch) and development of technological package

Project Code : I-54(d)

Duration : April 2006 - March 2009

Project Personnel : Kuldeep Kumar (PI), A. K. Sahu, P. V. Rangacharyulu, U. L. Mohanty and B. Mishra

of its seed. In 2007, same individuals of *A. testudineus* were bred in March, June and July by administering Ovaprim. In 2008, the fish showed better response to induced breeding, registering 31% and 89% fertilization, respectively in February and March.

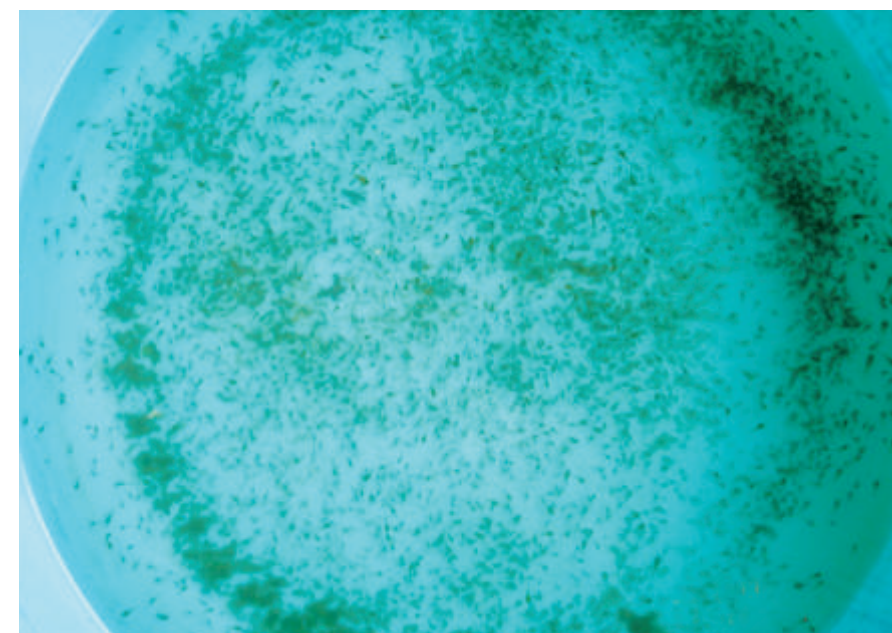
The breeding programme resulted in production of over 40,000 fry during the year. It is concluded that the seed production can be enhanced if the fish growers/ farmers apply multiple breeding techniques.

Multiple breeding of *Anabas testudineus* for mass scale seed production

The climbing perch breeds only once in a year in nature and breeding season lasts from May to August. Attempts were made to breed the fish several times in a year during its annual reproductive cycle, to meet the growing demand

Fryrearing

In an experiment on *A. testudineus* fry rearing, about 40% increase in body weight was registered in one month. From third day onwards, the spawn were fed with plankton after thorough sieving to avoid the entry of larger predatory copepods and cladocerans, which generally harm and consume tender hatchlings. After 20 days, pulverized formulated feed having ingredients like rice bran, GNOC and fish meal was added to their food ration. Initially after 10 days and then once in a week the larger fry were removed to avoid any possible cannibalism, which is very common in this fish.



Anabas fry



An haul of *Anabas*

Table 11. *****

Tanks	Culture period (Months)	Density/m ²	Initial Av. size (g/cm)	Final Av. size (g/cm)	Recovery (%)	Production/ m ² (Kg)
Tank-I	7	33	7.2/7.04	14.30/9.39	100	0.47
Tank-II	7	40	3.7/5.05	13.25/8.94	100	0.53

Culture of Anabas in cage

Five cages were stocked with varying stocking densities of Anabas (Table 12). While three cages were floating-type, two cages were kept in such a way that their bottom should touch the bottom soil. Water parameters were monitored regularly. The maximum production i.e. 1.0 kg/m² was achieved in 165 days of culture when the rate of stocking was 67 fish/m². The rate of recovery varied between 39.11 to 91.11%. It has been further observed that the cages which were touching the pond bottom gave better production in comparison to the floating ones (Table 12).

Table 12. Culture of Anabas in cages (*cages touching the bottom)

Cage	Culture period	Stocking density/m ²	Initial av. size (g/cm)	Final av. size (g/cm)	Recovery (%)	Production/ m ² (kg)
I*	140 days	33	1.97/4.94	24.7/9.74	91.11	0.75
II	140 days	74	1.97/4.94	10.4/7.02	58.4	0.45
III*	165 days	67	12.62/8.12	30.45/10.96	52.0	1.00
IV	375 days	30	4.12/6.25	24.36/11.4	82.5	0.59
V	375 days	33	4.12/6.25	24.11/10.46	39.11	0.31

Pond culture of Anabas

A stone lined pond was modified to prevent the escape of fish and stocked at 3-fingerlings/m² with an average size of 14.0 g/10.11 cm. In seven months of culture a production of 0.071 kg/m²/yr was achieved; fishes attained an av. size of 25.8 g/11.2 cm. In this experiment pond was manured with raw cowdung and fish were fed with formulated feed.



Advanced fingerlings of Anabas

Sub-project

: Culture of stripped murrel, *Channa striatus* and development of practices and package

Project Code

: I-54(e)

Duration

: April 2006 - March 2009

Project Personnel

: Kuldeep Kumar (PI), P. Kumaraiah (till January, 2008), A. K. Sahu, P. V. Rangacharyulu and U. L. Mohanty

Breeding and seed rearing

The fishes were bred in simulated natural environment created in the ponds. About 5500 fry were collected from project ponds.

Experiment on seed rearing was conducted in tank stocked with 200 advanced hatchlings of *C. striatus* (0.048 g/1.6 cm). Initially they were fed with plankton ad libitum. After two weeks of rearing, in addition to plankton finely ground fish meal was added to their ration. Once in a week the bigger fry were netted out and reared separately to avoid cannibalism. It has been observed that 2-3% of the fry grow very fast due to greater consumption of feed and start consuming the smaller ones. It was found that removal of smaller fry was essential for higher recovery percentage. During seven weeks of culture period, the fry grew to an average size of 9.0 g/10 cm. with only 17.13% of recovery.

Experiment on seed rearing was conducted in tank stocked with 200 advanced hatchlings of *C. striatus* (0.048 g/1.6 cm). Initially they were fed with plankton ad libitum. After two weeks of rearing, in addition to plankton finely ground fish meal was added to their ration. Once in a week the bigger fry were netted out and reared separately to avoid cannibalism. It has been observed that 2-3% of the fry grow very fast due to greater consumption of feed and start consuming the smaller ones. It was found that removal of smaller fry was essential for higher recovery percentage. During seven weeks of culture period, the fry grew to an average size of 9.0 g/10 cm. with only 17.13% of recovery.

Results of another experiment are given in Table 13.

Experiments were also conducted on fingerling rearing of *C. marulius*. The fingerlings showed about 10 fold increase in body weight with 75% recovery in three months.

Culture of murrel in tanks

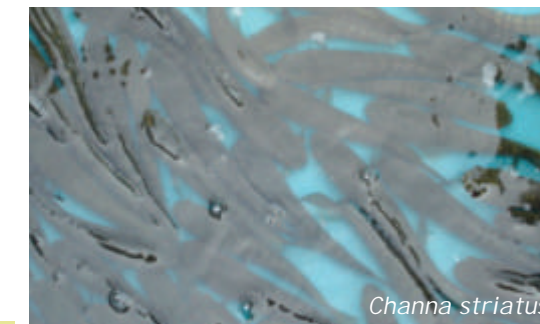
Results of culture of murrel in concrete tanks are formulated in table 14.



Hatchlings of *Channa striatus*

Table 13. Fingerling rearing of *C. striatus* in tanks

Tanks	Culture Period (days)	Density/ m ²	Initial Av. size (g/cm)	Final Av. size (g/cm)	Recovery (%)
1	75	67	0.068/1.9	21.4/ 13.9	31.3
2	75	67	0.068/1.9	14.77/12.3	34.5



Channa striatus



Tank reared juveniles of *C. striatus*



Channa marulius



Tank reared juveniles of *C. marulius*

Table 14. Culture of murrels in tanks

Tanks	Density/ m ²	Culture period (weeks)	Initial av. size (g/cm)	Final av. size (g/cm)	Recovery (%)	Production/ m ² (kg)
Tank I	6	16	17.60/13.65	105.12/23.78	100	0.63
Tank II	8	16	17.60/13.65	94.17/22.82	100	0.69
Tank III*	11	15	30.45/16.25	71.27/23.18	99	0.783

Tank with *C. marulius**

Sub-project : Freshwater pearl mussel culture
Project Code : I-54(f)
Duration : April, 2006 - March, 2009
Project Personnel : Kuldeep Kumar (PI), S. Nandi, P. Das, R. N. Mondal, Ashis Saha and U. L. Mohanty

Food spectrum of pearl mussel

A study on the gut contents showed that the maximum number of organisms that freshwater mussels feed upon belong to green algae, followed by diatoms, blue green algae and few taxa of zooplankton. It was observed that Scenedesmus, Synedra, Chlorella, Merismopedia, Botriococcus, Brachionus were present in gut content of the mussel, while species like Scenedesmus, Synedra, Chlorella, Merismopedia, Botriococcus, Brachionus, Cyclops, Naupli, Diaptomus, Osphrasticum, Mesocyclops, Pediastrum, Moina etc. along with the above mentioned species were found in the habitat of the mussel.

Breeding

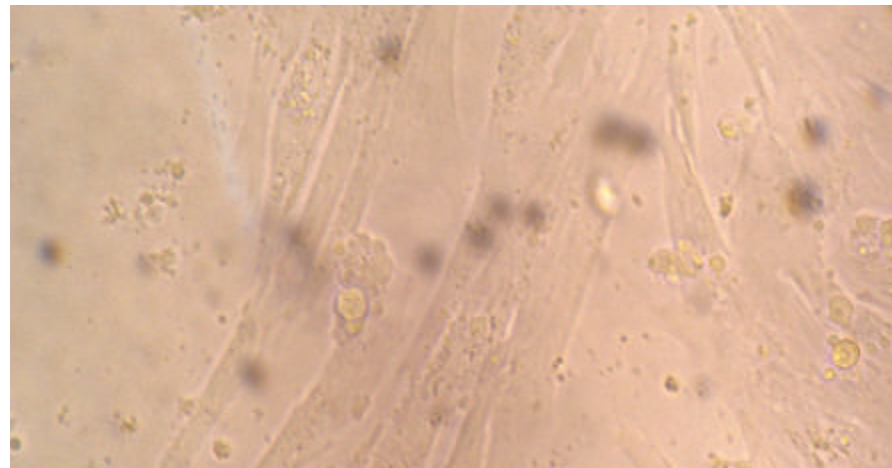
Breeding trials of *L. marginalis* were made and eggs were released in the tanks having different fishes for egg attachment. Seventy specimens of *L. marginalis* were induced to release eggs by sudden increase of water temperature to 42C.

Studies on growth performance

An experiment has been initiated to observe the growth rate of the two pearl mussels i.e. *Lamellidens marginalis* and *Peresia corrugata*. Initial observation on the growth rate reveals marginal growth i.e. 1.5 mm/month in *P. corrugata* and 1.8 mm/month in case of *L. marginalis*.

Studies on in vitro culture of mantle epithelial cells

In vitro culture of the mussel mantle epithelial layer showed that the treatment with collagen was better than trypsin in dissociating mussel tissue fragments.



9 day of culture of mantle epithelial cells of mussel

Sub-project : Characterization of growth pattern of diversified carp species under monoculture
Project Code : I-54(g)
Duration : April 2007 - March 2010
Project Personnel: P. C. Das (PI), N. Sarangi, J. K. Jena and B. Mishra

Grow-out monoculture of Puntius sarana at varied stocking densities

Results of monoculture experiment of *Puntius sarana* in earthen ponds are depicted in Fig. 6. Higher growth achievement of this species in T1 with 5000 fish/ha stocking density followed by T2 and T3 is indicated.



Fig. 6. Growth rate of *P. sarana* during monoculture at varied densities



Fig. 7. Growth rate of *L. rohita* during monoculture at varied densities

Sub-project : Influence of nutrients factor on growth performance of *Eichhornia crassipes* and *Vallisneria spiralis*

Project Code : I-54(h)

Duration : April 2007 - March 2010

Project Personnel: R. N. Mandal (PI), S. Adhikari and K. C. Pani

Nutrients' status of water and soil in different spots of *E. crassipes* and *V. spiralis* were found more or less similar at their respective habitats across the different months. On the other hand, climatic factor, particularly rainfall was recorded maximum during July-August. Result showed that *E. crassipes* exhibited peak growth during rainy months (Fig. 8). Its growth reduced gradually, when rainy period was over. Importantly, water temperature did not have any considerable influence upon them. In case of *V. spiralis*, growth was triggered during rainy months, but unlike *E. crassipes*, its growth continued afterwards (Fig. 9). Like *E. crassipes*, temperature did not have any influence upon this species. Based on this survey in respective habitats it may be concluded that nutrients may not have that much significant influence on the growth of these two aquatic macrophytes as like rainfall.

Glass jar experiments at laboratory showed that environmental manipulation (addition of secondary nutrients) could restrain the normal

Grow-out monoculture of *Labeo rohita* at varied stocking densities

Results of monoculture of *L. rohita* in earthen ponds are depicted in Fig. 7. Almost similar growth achievement at the end of the five months culture despite the varied stocking densities is indicated.

growth of *E. crassipes* and *V. spiralis*. Thus higher doses of nutrients affected the plant growth to higher extent in minimum time (Tables 15 & 16). Analysis of water parameters at post treatment period revealed no significant changes among nutrient constituents of water.

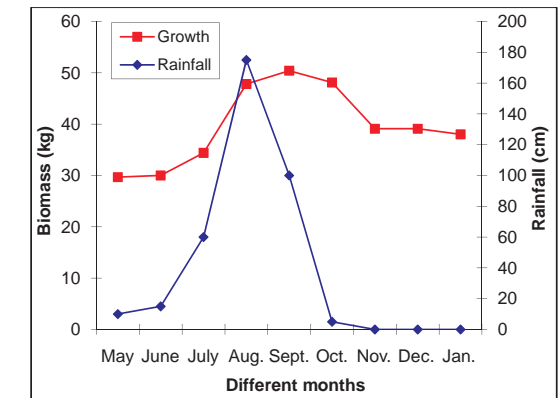


Fig. 8. Relationship between the growth of *E. crassipes* and rainfall

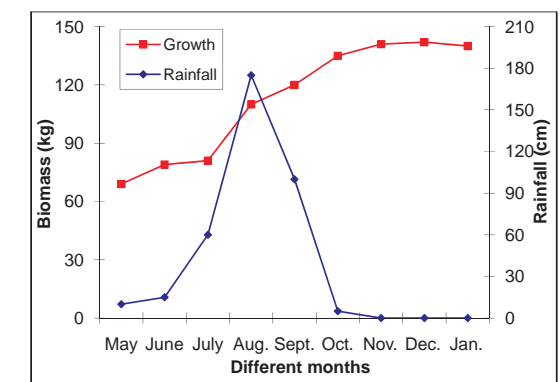


Fig. 9. Relationship between the growth of *V. spiralis* and rainfall

Table 15. Control of *E. crassipes* by manipulating nutrients

Different glass jars	Biomass (g)	Chemical doses (mg/10 l)	Observation
E-1	500	1.5	Survived
E-2	500	2.0	Partially damaged
E-3	500	2.25	Partially damaged
E-4	500	2.5	Died after 2 months
E-5	500	3.0	Died after 2 month

Experiments were replicated five times

Table 16. Control of *V. spiralis* by manipulating nutrients

Different glass jars	Biomass (g)	Chemical doses (mg/10 l)	Observation
V-1	250	1.5	Survived
V-2	250	2.5	Survived
V-3	250	3.0	Partially damaged after 2 months
V-4	250	3.5	Partially damaged after 2 months
V-5	250	4.5	Died after 2 month

Experiments were replicated five times

Sub-project : Design, development and performance evaluation of improved mechanized fish harvesting system for aquaculture pond

Project Code : I-54(i)

Duration : April 2007 - March 2010

Project Personnel: K. K. Sharma (PI), S. Chand, B. Sarkar and S. K. Nayak

Mechanization can lessen the manual labour involved in fish harvesting. A motor-driven mechanical fish-netting device for a rectangular fish pond has been designed, developed and installed at the Institute farm complex. The system includes a motorized trolley, a rail track and netting arrangement. Motorized trolleys are placed on the rail tracks on both sides of the pond dykes. A boom pipe has been designed and mounted on each trolley according to the dyke slope to support the net assembly including proper movement of net providing appropriate hang to prevent escape of fishes. The boom pipe can rotate in both directions either horizontally or vertically depending upon the operational requirement. The fish net is fixed in between the trolleys with the boom with foot rope and head rope of the net tied with the extension arrangement provided on the trolley. The trolley

travels with uniform speed of 3 m/min, which can be varied by changing the gear system. The present system can carry 1 to 1.5 tons fish load in a single operation.

Several operational trials have been made to test its efficiency and performance for catching fishes from a grow-out pond. The pond was stocked with Indian major carps viz. rohu (*Labeo rohita*), catla (*Catla catla*) and mrigal (*Cirrhinus mrigala*). Depth of water in the pond was maintained at 1.5 m. After repeated trials, it was observed that in a single operation by mechanized netting system, the catch efficiency for rohu was found to be 80%, catla almost 100% and mrigal 70%. Hence the overall efficiency is more than 80 per cent. Based on the performance of the system, it could be predicted that the newly developed mechanized fish harvesting device has got wide scope for its adoption by commercial aquaculturists to increase their catch efficiency, reducing labour cost, saving time of harvesting. This mechanical device, the first of its kind in the country, would be more advantageous for fish harvesting thereby making aquaculture more attractive and profitable.

Sub-project : Mass seed production and grow-out culture of diversified catfishes: *Pangasius pangasius* and *Horabagrus brachysoma*

Project Code : I-54(j)

Duration : April 2007 - March 2010

Funding Agency : Institute funded

Project Personnel: S.K. Sahoo (PI), S.S. Giri, A. K. Sahu and S. Chandra

Observations on breeding and rearing of Pangas Male (1.3-1.6 kg) and female 1.4-1.8 kg) pangas were administered with 1 ml/kg as 1st and 0.8-1.0 ml/kg as 2nd injection of Ovaprim. Ovulation success was 4-12%. The embryonic development of the eggs continued till hatching. The fecundity was 0.5-1.5 lakhs/kg body weight. The hatching percent was 12-15% and hatching occurred after 28-29 hours of incubation.

The newly hatched larvae were transparent and yolk sac got absorbed on third day post-hatching. Unusual swimming behaviour was observed during rearing phase. Most of the larvae were weak and settled at the bottom. The larvae were active during 6-7th day of hatching. Continuous mortality was observed during entire 12 days of rearing resulting in a recovery of only 260 fry.

Observations on breeding and rearing of *H. brachysoma*

Four doses of Ovaprim (0.5, 1.0, 1.5 and 2.0 ml/kg) were evaluated to see the breeding performance and egg quality of yellow catfish. The females injected with lowest dose did not respond. The Ovaprim dose of 1 ml/kg at 12 h latency was found to be best with >90% fertilization and >75% hatching during the trials. Although dosage of the hormone did not have any affect on the weight or number of eggs, egg quality was poor at the highest dose.



Pangas

The fry were taken to nursery pond after one, two, three and four weeks of rearing for fingerling production. It was observed that the larvae reared for two weeks and above performed well resulting >80% survival during fingerling production. So the larvae of this catfish should be reared at least for two weeks in indoor system before utilizing them for fingerling production.

Sub-project : Breeding and culture of *Rhinomugil corsula* (Ham.) and its incorporation in polyculture

Project Code : I-54(k)

Duration : April 2007 - March 2010

Funding Agency : Institute funded

Project Personnel : Radheyshyam (PI) and S. K. Sarkar

Fingerling collection

Seed resource inventory of *Rhinomugil corsula* was carried out in River Daya and nearby freshwater village ponds. A total of 272 advance fingerlings of 10-20 g and 559 fingerlings of 1.25-2.45 g were collected and stocked in 0.08 ha pond in the month of November, 2007. Fingerlings were fed daily with wheat bran.

Growth study of *Rhinomugil corsula* on different feeds

Four experimental feeds (F-I, F-II, F-III and F-IV) were prepared and fed the fingerlings of *Rhinomugil corsula* in four treatments separately to study the feed acceptability and growth performances. In four months of rearing, the fingerlings registered 3.8, 4.0, 5.6 and 2.6 fold growth, respectively in the four treatments.

Sub-project : Stock comparison and development of base population of giant freshwater prawn *Macrobrachium rosenbergii*

Project Code : I-54(L)

Duration : April 2007 - March 2009

Funding Agency : Institute funded

Project Personnel : Bindu R. Pillai (PI), K. D. Mahapatra, J. Mohanty, P. K. Sahoo and Lopamudra Sahu

Collection and rearing of *M. rosenbergii* stock (juveniles) from river Narmada, Gujarat, Cochin backwater system, Kerala, and river Mahanadi, Orissa

Stocks of *M. rosenbergii* (juveniles) were collected from river Narmada, Bharuch, Gujarat, Cochin backwater system, Kerala and from river

Mahanadi, Kendrapara, Orissa and were transported to the CIFA farm facility for rearing separately in 0.04 ha earthen ponds. The prawns are fed with pellet diet twice daily at 10% of the biomass per day. They are sampled on a monthly basis to study their growth and health status. Stocks brought from Kerala and Gujarat were screened for white muscle virus using diagnostic kits developed by CIFA and were found virus-free. Adult stocks of *M. rosenbergii* were transported during 2006 and bred under laboratory conditions. The post-larvae obtained from them were pooled, reared for one month in outdoor cement tanks and then released to earthen ponds for further growth.

Evaluation of soft visible implant alpha numeric tags (VI Alpha) in *M. rosenbergii*

One experiment was initiated during October 2007 to evaluate soft visible implant alpha numeric tags (VI Alpha) in juveniles, sub adult and adult *M. rosenbergii*. The VI Alpha tag is a small fluorescent tag with an alphanumeric code designed to identify individual specimen. VI Alpha tags are implanted internally but remain externally visible for easy recovery. One hundred and five prawns (juvenile, sub adult and adult prawns) were tagged with standard size format and released into nine tanks of 3600 l capacity (three tanks for each group) and reared under laboratory conditions for ten weeks to evaluate

the tag retention and readability. Control prawns were also reared to study the effect of tagging on growth and survival. Results are presented in the tables 17&18.

The growth and survival of control and tagged prawns were not significantly different indicating that the VI Alpha tag has no negative effect on growth and survival in this prawn.

Project Title : Genetic improvement of freshwater prawn, *Macrobrachium rosenbergii* (de Man) in India

Project Code : E-42

Duration : April 2007 - April, 2009

Funding Agency : World Fish Centre, Malaysia

Project Personnel: Bindu R. Pillai (PI), K. D. Mahapatra, N. Sarangi, S. C. Rath and Lopamudra Sahoo

Unilateral eyestalk ablation (UEA) was evaluated as a means of synchronization of ovarian maturation in adult female *M. rosenbergii*. Results revealed that though UEA provided some acceleration in ovarian maturation, it was not sufficient to synchronize the maturation. Additional infrastructure was developed for the work on selective breeding. The first workshop of the project was conducted at the Institute on 17 March, 2008.

Table 17. Effect of VIA tagging on growth and survival of different stages of *M. rosenbergii*

Parameters	Juvenile		Sub-adult		Adult	
	Control	Tagged	Control	Tagged	Control	Tagged
Initial Weight (g)	1.7±0.11	2.1 ±0.35	12.9±0.40	17.9±2.69	26.7±3.24	29.4±1.37
Final Weight (g)	3.2±0.22	3.8 ±0.31	15.1±0.36	20.8±3.21	29.5±3.19	32.2±0.59
Duration (days)	76	76	70	70	70	70
Survivability (%)	100.0	100.0	92.8	100	100	100
Growth (mg/day)	20.5±1.1	22.4 ±0.95			40.6	40.0

Table 18. Retention and readability of VIA tags in different life stages of *M. rosenbergii*

Parameters	Juvenile	Sub-Adult	Adult
Tag Retention (%)	69.8±2.9	92.30±7.69	65.0±5.0
Tag Readability (%)	100.0	91.6±0.7	84.52±1.19

Project Title : Standardisation of breeding and rearing of some of the commercially important ornamental fishes with greater emphasis to indigenous species

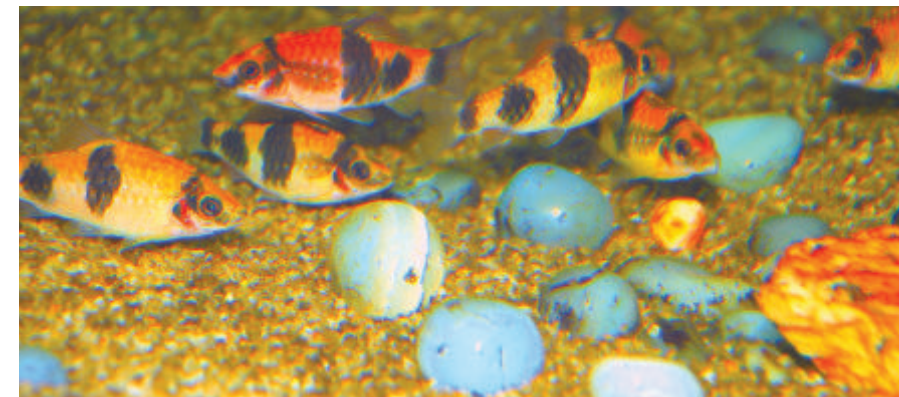
Project Code : I-41

Duration : April 2004 - March 2009

Funding Agency : Institute-based

Project Personnel : S. K. Swain (PI), P. Kumaraiah (till January, 2008), K. D. Mohapatra and S. K. Singh

Breeding of *Puntius fasciatus* (Melon barb)- Six sets of melon barb of average weight 5.30 g (1:2 male and female) were bred in ferro-cement tanks by simulating natural environmental condition. Fry (5 mm size) of 180 nos were recovered from them after 30 days of rearing. Larvae were reared initially with infusorians as live feed for 15 days. Further they were fed sieved zooplankton twice a day.



Brood stock of *Puntius fasciatus* (Melon barb)

Breeding of *Brachydanio frankei* (Leopard danio)

The male and female broods (30-35 mm) were kept separated one month prior to breeding and were fed ad libitum zooplankton and granular feed. Since eggs were non-sticky, 6 pairs of male and female were kept in small mosquito hapa net, which was placed in glass aquaria in triplicate. Successful breeding was done in infusorians populated water developed naturally by planting

Hydrilla plant 15 days prior to spawning. Spawning intervals were found to be typically much longer, varying from 5 days to several weeks, in each batch the female laid 20-50 nos. eggs. Hatching time recorded was approximately 28-38 hours after spawning. Fecundity was 300-400 eggs per matured female.

Brood stock development of other important *Puntius* species

For developing brood stock, *Puntius filamentosis* (30-40 mm) were collected from south India. They were acclimatized in aquaria tank conditions and fed with mixed zooplankton and granular feed. After 3 months of rearing, they attained body length of 45-48 mm. Sofore barb, *Puntius sophore* (35-40 mm) was collected from natural sources and reared for development of broodstock in cement tanks. After 3 months of care they attained size of 45-52 mm.

Effect of stocking density on growth and survival of rosy barb, *Puntius conchonus* larvae in different culture conditions

Seed rearing of rosy barb (av. length 14 mm and weight 0.116 g) was undertaken in cement tanks of size 2.4x0.9x 0.5 m (1.08 m³) under shade net condition for a period of 60 days. The stocking density of larvae was maintained at four treatment conditions (T1, T2, T3 and T4) at 200, 300, 400 and 500 nos respectively in 0.50 m water depth under the shade net tanks. The experiment was conducted in triplicate and a common powdered feed having 40% protein was fed to the larvae, twice a day ad libitum. The physico-chemical parameters of tank water were



Culture of koi carp in cages



monitored and the growth and survival data was recorded during the experiment. The mean final growth of fishes was recorded as 24.2 mm/0.25 g, 24.2 mm/0.23 g, 22.2 mm/0.20 g and 20.0 mm/0.18 g, respectively in four treatments. The survival rate was recorded as 98.0, 92.0, 74.0 and 69.0% in four treatments (T1 to T4). The present result suggests that low stocking density leads to higher growth and survival of the fishes.

Performance of growth and survival of koi carp in cage and cement tank

Koi carp fingerlings (av. initial weight 4.72±0.21 g, length 60.24±1.62 mm) were stocked in two cages of size 10 m² along with Indian major carp, rohu (av. initial weight 3.7±0.108 g, length 73.28±0.66 mm) at 15 no/m² for each species. The cages were placed in small reservoir to observe the growth and survival of fishes. The final weight of koi carp was 18.88±1.82 g and 103.33±3.99 mm body length and for that of rohu, it was 114.28±1.8 g and 201.35±1.29 mm during the culture period of 3 months. The survival of koi and rohu was 41.66% and 22.33% respectively. A parallel experiment was conducted in cement tanks with a stocking density 30 nos/m² substituting rohu with koi carp in two cement tanks of size 6x2x0.75 m. The average final growth of koi carp recorded was 15.30±1.5 g and survival 90.4%. Pelleted feed having of 35% protein was provided in the tank twice a day at 3% of body weight. However, the pigmentation in koi carp was brighter red in cages as compared to those reared in cement tanks.

Project Title : Development of sustainable seed production and culture technologies of Macrobrachium species

Funding Agency : Institute-based

Sub-project : Development of technological packages for grow-out culture of Ganga river Prawn Macrobrachium gangeticum

Project Code : I-47(a)

Duration : April 2005 - March, 2009

Project Personnel : Radheyshyam (PI), and A. N. Mohanty (upto Dec. 2007)

Brood stock maintenance and seed production for *M. gangeticum* culture

In order to produce seed of *M. gangeticum*, brood stock was maintained in plastic pool (12' dia and 4' height) containing 6000 l pond water. Prawns were fed with mussel meat and egg custard twice daily. Berried condition of prawns appeared in



Sample catch of *M. gangeticum*

July and continued till November, 2007. From 3 May, 2007 to 30 October, 2007, total 11 larval production cycles were carried out using 56 berried *M. gangeticum* of 65-110 mm body length and 4-17 g weight. First PL appeared on day 20-26 and the cycle was completed in 34-57 days. A total of 21,944 PL were produced.

Juvenile nursing of *M. gangeticum* for grow out culture

Four experimental rearing trials T-I, with commercial feed (G); T-II, with commercial feed (H) + mussel meat; T-III, with commercial feed (H); T-IV with commercial feed (G + mussel meat) containing 500 number of *M. gangeticum* with average length 33 mm and weight 0.2 g were carried out. Highest survival (89%) was recorded in T-IV followed by T-II (86%) and lowest was in T-I (82%). The highest growth was seen in T-II (0.984 g) followed by T-IV (0.848 g) and T-III (0.832 g). In T-I, growth was the lowest. The study suggests that for proper growth and survival of prawn juveniles, provision of live feeds (mussel meat) along with commercial feeds during rearing phase is beneficial.

Brood stock management and PL production for culture of *M. malcolmsonii*

Fifty-three brood stock of *M. malcolmsonii* were collected from the culture pond and reared in stone lined pond (0.008 ha). Fifteen berried prawns were used for breeding operation of 1 month. Post-larval production and recovery were poor, 13 numbers of PL/g body weight of berried prawn and 1.47-2.66%, respectively.

Sub-project : Mono and polyculture of freshwater prawn for technology refinement at rural front

Project Code : I-47(b)

Duration : April 2004-March 2008

Project Personnel : Radheyshyam (PI) and A. N. Mohanty (upto Dec. 2007)

To study the effects of stocking size of prawn seed on survival, growth and production, six

experimental trials have been carried out in triplicates in 0.05-0.10 ha village ponds. Experimental trials- T-I, T-II, T-III, T-IV, T-V and T-VI were stocked with 0.1, 0.5, 1.0, 1.5, 2.0 and 2.5 g of *M. malcolmsonii* seed at 25,000/ha respectively. Each of the ponds was stocked with *Catla catla* (av. wt. 5.2 g) and *Labeo rohita* (av. wt. 2.3 g) at 3000/ha. In T-I, T-II, T-III, T-IV, T-V and T-VI the prawn recovery was 19.03, 27.00, 35.80, 38.80, 42.52 and 43.60% respectively in about 7 months of rearing. Prawn yields ranged between 178.19 and 823.16 kg/ha/yr (Fig. 10) and their contribution to total production in poly culture ranged from 5.98-28.54% (Fig. 11). Prawn yield contribution to total production increased with the increase of stocking size of the prawn seed. The present study indicated that 2- 2.5 g stocking size of prawn seed is the most suitable combination in grow out polyculture for better survival, growth and production.

Excel File Required

Fig. 10. Prawn and fish yield in polyculture stocked with different size prawn seed

Excel File Required

Fig. 11. Percentage composition of prawn and fish production in polyculture

Project Title : Refinement of hatchery technology for seed production of Gangetic prawn *Macrobrachium gangeticum* (Bate) synonym *Macrobrachium birmanicum choprai* (Tiwari)

Funding Agency : ICARAP Cess Fund Scheme

Project code : E-28

Duration : October,2004-November,2007

Project Personnel : Radheyshyam (PI), A. N. Mohanty

Males and females of *M. gangeticum* produced in the hatchery were reared together in plastic pool containing 6000 l pond water to develop brood stock for seed production. Berried condition first appeared in April 2007. Their availability continued up to the end of October 2007.

The berried females bearing grey coloured eggs were used for incubation in captivity using 5 ppt brackishwater under aeration. Hatching of the incubated eggs commenced from May and continued upto October 2007 in different cycles. Larval rearing was carried out from May to October 2007 in brackish water of 14-18 ppt salinity, prepared by diluting seawater. Total 21,944 post larvae at 20-38 PL/L were produced under hatchery conditions at water temperature

rearing from 27.4 to 29.6C. Particulars of post larval production are given in Table 19.

Development of innovative sand filters for prawn hatcheries

Conventional sand filters suffer from rapid clogging. Hence an attempt was made to develop an improved model of sand filter, which is more effective in its function and less demanding for maintenance.

Four models (CIFA_{CM}, CIFA_{CS}, CIFA_{RL} and CIFA_{RM}) were developed. Among these model CIFA_{RM} is four-chambered and is designed for use in larger tanks, pools, nursery ponds etc. A pressure unit in the form of a water pump (0.5 HP/Tulu-60) has been used for creating pressure-inflow of water into the filter unit from the culture tank through a suction pipe placed inside an immersed PVC circular pipe wrapped up with a suitable mesh nylo-bolt cloth termed as "Animal Preventor (AP)". The discharge water is recycled again in the same tank through the delivery pipe effecting in situ re-circulatory filtering system.

There are many advantages in the developed sand filter system as compared to the conventional sand filters commonly used elsewhere in prawn hatcheries. It facilitates in situ filtration of rearing medium without disturbing the culture species and is ideal for semi and intensive culture practices. It is highly efficient in recycling the water in freshwater prawn hatchery and reducing

Table 19. PL production of *M. gangeticum* from May, 2007 to October, 2007

Duration	No. of berried females	Range (size)	Range wt. (gm)	No. of PL
3.5.07-6.6.07	4	70-100	4-15	1563
5.5.07-15.6.07	3	68-100	4-16	1465
10.6.07-2.7.07	11	75-104	5-15	4118
15.6.07-9.7.07	9	77-109	5-16	1666
24.7.07-6.8.07	1	80-100	5-16	1275
13.8.07-4.9.07	6	82-99	4-16	1408
17.8.07-2.9.07	2	88-102	4-14	1525
22.8.07-5.9.07	1	70-110	5-16	1927
25.8.07-0.9.07	7	65-106	4-17	1555
3.9.07-7.10.07	9	82-100	6-16	2787
4.9.07-0.10.07	3	83-109	4-15	2655
Total	56			21,944

the brackish water requirement. Since, it is portable, it can be installed in any aquaculture system, which generates low to medium quality wastewater and is very easy to operate. It does not require frequent back washing and the filter media does not require replacement even after operation for one year. No chemicals are used and therefore it does not affect water quality. It is cost-effective, much less labor intensive, reliable and provides much higher flow rate than a slow (gravity) filter. Accumulated waste materials of the filter during back washing or replacement do not appear to be toxic and is environmentally safe for landfill disposal.

Project Title : Economic and livelihood development of SC/ST population through freshwater aquaculture technologies

Project Code : E-36

Duration : April 2006-March 2009

Funding Agency : Dept. of Biotechnology, Govt. of India

Project Personnel : N. Sarangi (PI), B. K. Das, B. C. Mohapatra, H. K. Dey, D. N. Chattopadhyay and Suresh Chandra

During the current year, 28 SC farmers and 60 ST farmers covering a culture area of 9.49 and 9.88 ha in Kendrapara and Keonjhar districts respectively were adopted. On site demonstration regarding common carp breeding was extended to two additional beneficiaries in Kendrapara district. The technological know-how regarding freshwater aquaculture has been imparted to them. Table 20 furnishes information on supply of seeds in Keonjhar and Kendrapara.

Grow-out carp culture

Stocking of IMC fry was done in all the adopted ponds of Keonjhar (52 nos.) and 18 adopted ponds at Kendrapara during the month of August and September 2007. Body weight of carps have been recorded and it ranged from 50-165 g and 360-750 g at Keonjhar and Kendrapara ponds respectively after a culture period of six months (Table 21).

Seed rearing of Jayanti rohu- a genetically improved variety

Supply of spawn of the genetically improved variety of rohu (Jayanti rohu) resulted in production of 0.07 and 0.08 million fry at Tanar and Sirsipal respectively, which were subsequently stocked for fingerlings' production.

Monoculture and polyculture of freshwater prawn

Monoculture of freshwater prawn was conducted in nine adopted ponds at Baharagarh, Kendrapara. Prawn juveniles weighing 15-20 g were provided from Honsua river for stocking which attained an average weight of 70 g after a culture period of four months (Table 21). Polyculture of freshwater prawn was conducted in seven adopted ponds in hilly areas of Keonjhar. Scampi PL (21 days) could establish and attain a weight of 25-30 g within a culture period of five months (Table 21).

Culture of advanced fingerlings in seasonal ponds

Advanced fingerlings were provided to ten adopted farmers (2,500 nos. weighing 25-30 g) of Tulasichaura, Sirsipal and Saraswati SHG of Bishnudasapur (2,250 no. each weighing 40 g) so as to enhance the production of the adopted ponds in



Fry-staged IMC are being provided to the beneficiaries

that region (Table 20). The advanced fingerlings of IMC supplied at Keonjhar Sadar have shown encouraging results (catla have attained 400-700 g, rohu 350-600 g and mrigal 200-300 g) within a culture period of six months.

Installation and operation of portable FRP hatchery

FRP hatchery having production capacity of 10 lakhs major carp spawn per operation was installed both at Tanar village in Kendrapara District and Sirsipal village in Keonjhar District for easy affordability of quality fish seed at the farmers' end. Farmers were encouraged for taking up seed rearing of carps as an economic enterprise for getting better returns in a short duration. One of the beneficiaries was a Self Help Group which has earned Rs 30,000/- within a short span of six months by selling fingerlings of major carps.

Breeding of rohu and common carp

During August 2007, induced breeding of Labeo rohita was conducted in FRP hatchery installed at Tanar and Sirsipal (Table 22). A total 0.625 million (two trials) and 0.6 million (one trial) spawns of Labeo rohita could be produced, which were stocked in nursery ponds for further rearing. Breeding of common carp Cyprinus carpio in cloth hapa with/without using Ovaprim as inducing agent was conducted at Tanar and Apilo, Kendrapara and Sirsipal, Keonjhar during January-March 2008. A total of 16 females (1-3.25 kg) and 21 males (0.75-1.75 kg) were bred during the reporting year (Table 23). In the current year, a total of 3.475 million carp spawn, 0.515 million fry and 0.203 million fingerlings were produced.



Harvest of table sized carps (owner Mr. S. Behera) at Aul BI

Development of yearlings bank

The concept of yearling production of Indian major carps has been disseminated to the farmers in both the Districts. Two progressive beneficiaries had been identified who were inspired to adopt the concept of yearling production at Sirsipal and Tanar. Activities like seed rearing of Jayanti rohu, IMC and common carp have been undertaken at these two places with a vision of developing the same into the nucleus of a satellite-yearling farming system.

Site-specific integrated farming system

Site-specific integrated aquaculture system was adopted in both Districts of Keonjhar and Kendrapara. Beneficiaries took interest in horticulture and floriculture components in the first phase in current year and planted seasonal vegetable and flower saplings on their pond dykes and in areas adjacent to fishponds. Around 10-15% of the horticulture products have been used by the farmers for domestic consumption and the rest were sold in the market which added on an average Rs. 3495 per annum to their food basket.

Fish production from carp polyculture

The average fish production from the adopted farmers' ponds in Keonjhar and Kendrapara prior to adoption was 230.99 kg/ha and 676.72 kg/ha respectively. After intervention, the average production from the adopted farmers' ponds in Keonjhar and Kendrapara has been recorded to be 491.62 kg/ha (Fig. 12) and 972.19 kg/ha/annum (Fig. 13). With CIFA's intervention and support, fish production from the adopted ponds of Keonjhar ranged from 100-1495 kg/ha. There has occurred two-fold increase in fish production for 50 adopted farmers (61.72%), 2-4 fold increase in production for 16 adopted farmers (19.75%), more than 4-fold increase for 6 adopted farmers (7.4%) and nil to present level production for 9 adopted farmers (11.11%) at Keonjhar (Fig. 14). The production from the adopted ponds of Kendrapara ranged from 121.53 - 4500 kg/ha. A two-fold increase in production was recorded for 17 adopted farmers (53.13%), 2-4 fold increase for three adopted farmers (9.37%), four-fold increase

was recorded for three adopted farmers (9.37%) and nil to present level for nine adopted farmers (28.13%) (Fig. 15).

Income and Employment generation

The average annual income of the adopted farmers prior to adoption was Rs 1,524.00 and Rs 25691.00 for Keonjhar and Kendrapara respectively. After adoption, the average annual income of the adopted farmers of Keonjhar (Fig. 16) and Kendrapara (Fig. 17) has increased by 2.91 and 1.33 times respectively. In Keonjhar, the income level from pisciculture has increased 2-fold for 37 adopted farmers (45.69%), 2-4 fold for 19 adopted farmers (23.46%), more than 4-fold for 16 adopted farmers (19.75%) and nil to present level for 9 adopted farmers (11.11%) Fig. 18. In

Kendrapara, two fold increase in income for 22 adopted farmers (68.75%), two- four fold increase for two adopted farmers (6.25%), four-fold increase in income for 3 adopted farmers (9.37%) and nil to present level of income from aquaculture for five adopted farmers (15.63%) have been recorded (Fig. 19).

Other activities

The technological know-how on freshwater fish farming was extended to farmers of Village Bhagabanpur in Kendrapara District. The impact was assessed with the help of questionnaires from a total 109 people (including 35 women) who participated in the programme. On special request and interest by the farmers 'Free pond water and soil check-up camp' was also conducted at Bhagabanpur.

Table 20. Stocking of seeds (in nos.) in different Blocks of Keonjhar and Kendrapara

Blocks	Spawn (Jayanti rohu)	Fry (IMC)	Advanced fingerling (IMC)	Prawn PL	Prawn juvenile
Keonjhar Sadar	3,50,000	5,500	2,500	2,000	-
Ghatagaon	-	15,500	-	4,000	-
Telkoi	-	33,000	-	2,000	-
Total	3,50,000	54,000	2,500	8,000	-
Kendrapara Sadar	3,50,000	-	2,250	-	-
Rajnagar	-	19,000	-	-	1,045
Aul	-	16,500	-	-	-
Total	3,50,000	35,500	2,250	-	1,045
Grand Total	7,00,000	89,500	4,750	8,000	1,045

Table 21. Average growth of fish and prawn supplied to Keonjhar and Kendrapara Districts

Stage of fishes stocked	Growth (g) at Keonjhar	Growth (g) at Kendrapara
IMC fry	50-165	360-750
Advanced fingerling of IMC	200-700	420-450
Prawn post-larvae	25-30	100-150
Prawn juvenile	-	50-80

Table 22. Average weight of rohu selected for induced breeding

Date	Place	No. of Females	Av. weight of female (kg)	No. of males	Av. weight of male (kg)
07.08.2007	Tanar	6	0.64 ± 0.097	5	0.59 ± 0.124
08.08.2007	Sisipal	7	0.69 ± 0.134	9	0.75 ± 0.185
22.08.2007	Tana±	8	0.69 ± 0.215	10	0.74 ± 0.156

Table 23. Average weight of common carp selected for breeding operation

Date	Place	No. of females	Av. weight of female (kg)	No. of males	Av. weight of male (kg)
27.01.2008	Tanar	6	2.2 ± 0.5	8	1.5 ± 0.4
07.02.2008	Tanar	3	2.4 ± 0.5	3	1.5 ± 0.4
20.02.2008	Apilo	4	3.2 ± 0.1	5	2.5 ± 0.2
19.03.2008	Sirsipal	3	1	5	0.7 ± 0.1

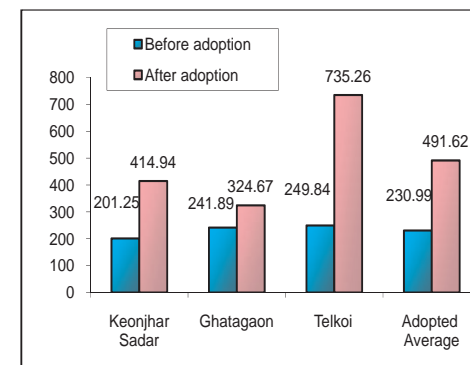


Fig. 12. Average fish production before and after adoption of farmers at Keonjhar

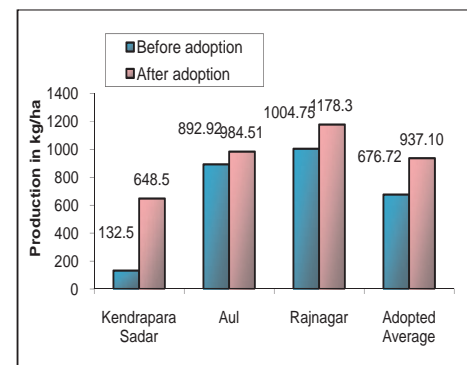


Fig. 13. Average fish production before and after adoption of farmers for Kendrapara

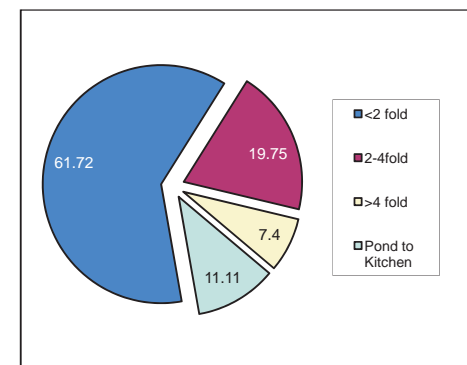


Fig. 14. Percentage of adopted farmers showing number of folds increase in fish production for Keonjhar

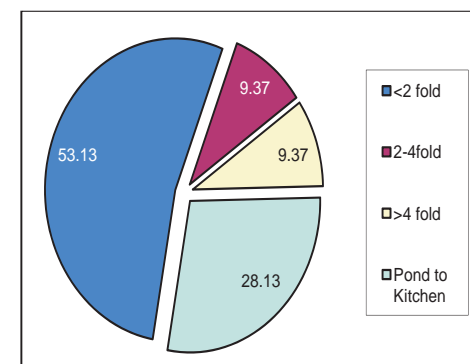


Fig. 15. Percentage of adopted farmers showing number of folds increase in fish production for Kendrapara

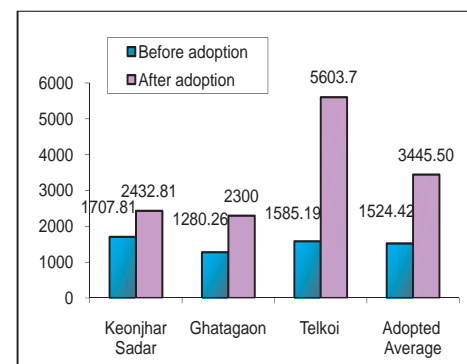


Fig. 16. Increase in income before and after adoption of farmers at Keonjhar

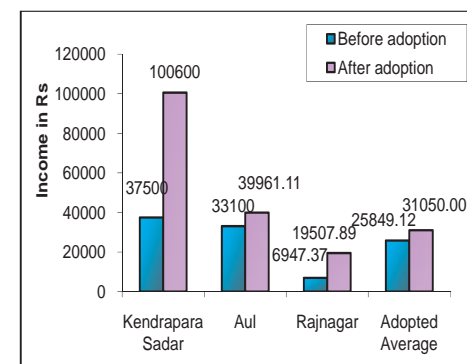


Fig. 17. Increase in income before and after adoption of farmers at Kendrapara

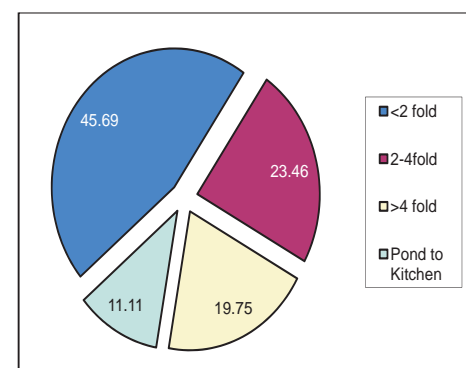


Fig. 18. Percentage of adopted farmers showing number of folds increase in income for Keonjhar

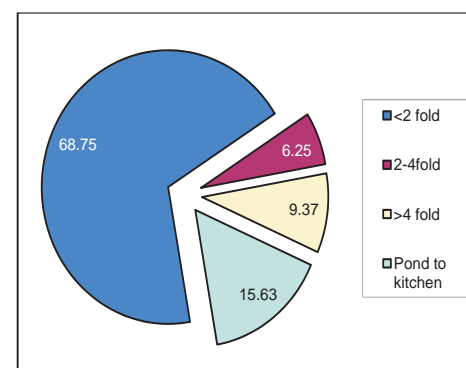
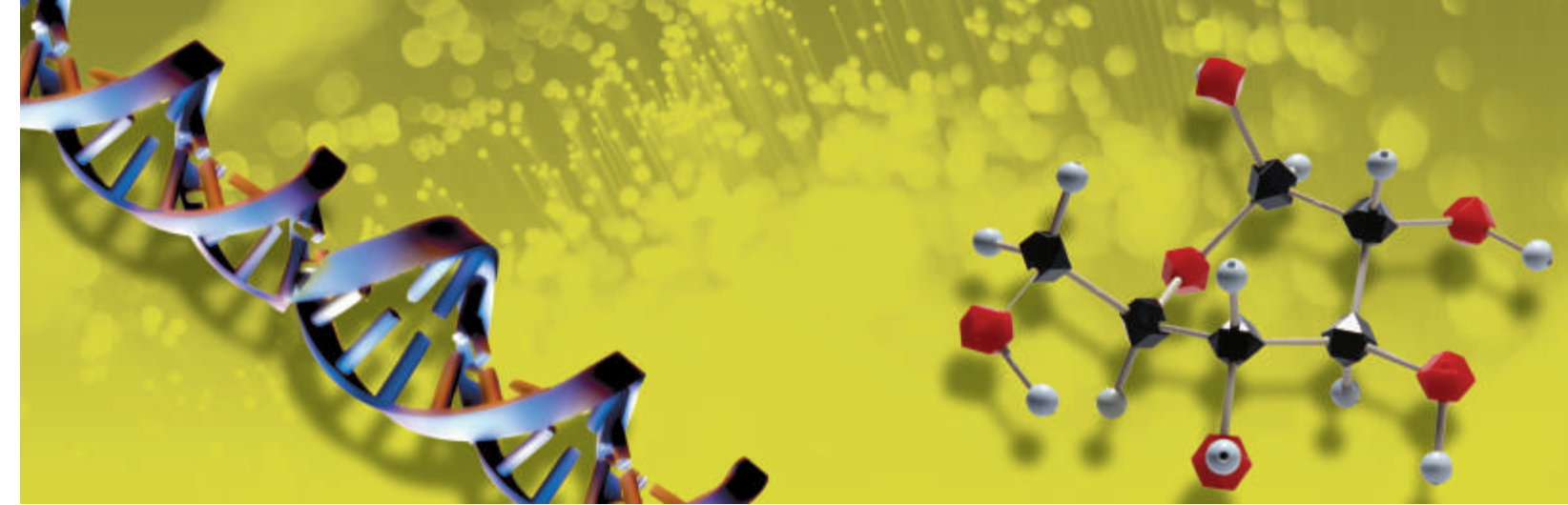


Fig. 19. Percentage of adopted farmers showing number of folds increase in income for Kendrapara



B. Fish Genetics and Biotechnology

Project Title : Genetic upgradation of freshwater fish and shellfish

Funding Agency : Institute-based

Duration : April 2007 - March 2010

Project code : I-59

Sub-project (a) : Genetic improvement of rohu for growth and disease resistance against aeromoniasis through sustainable selective breeding

Project Personnel : K. D. Mahapatra (PI) P. K. Sahoo, B. K. Choudhary and J. N. Saha

The sixth generation rohu selected for growth showed a realized selection response of 16.8% over the control. During 2007 year class, 62 fullsib families were produced from 52 sire and 32 dams. The control group was produced from fishes with average breeding values. In total 105.75 lakhs of improved rohu were produced during 2007 year class and 69.75 lakhs of improved rohu seed were disseminated to local farmers of Orissa, SC/ST beneficiaries in Keonjhar and Kendrapada in Orissa and Mau in UP. MoU with Sai Ram hatchery was extended for two years for dissemination of improved rohu in Andhra Pradesh and Maharashtra.

For disease resistance study, offspring were produced from 2004 year class challenged resistant and susceptible lines. They were stocked in triplicate nursery ponds for each line for further study. Tagging was completed for 1933 rohu fingerlings from 59 fullsib families, control group, resistant, susceptible lines for sustainable genetic

improvement of rohu for growth and disease resistance through selective breeding. Tagged fishes were stocked in three communal ponds for further study.

Challenge test was completed for resistant and susceptible lines against *A. hydrophila*. The challenge was performed in triplicates for both the lines. Resistant line showed 58.3 % higher survival than the susceptible line.

Project Title : Genetic upgradation of freshwater fish and shellfish

Funding Agency : Institute-based

Duration : April 2007 - March 2010

Project code : I-59

Sub-project (b) : Development of DNA markers in *M. rosenbergii* and genetic characterization of Jayanti families

Project Personnel : P. Das (PI), P. Jayasankar, K.D. Mahapatra, B.R. Pillai, P.K. Meher and J. N. Saha

In order to study the distribution and abundance of repeat sequences in *M. rosenbergii*, RAPD fragments generated from selected random primers were subjected to DNA hybridization using GT, CT, CAG, AAC, GACA and GATA repeats. GT repeats were found to be most abundant followed by CT and CAG. Based on the above results, a partial genomic library was made using DNA fragments ranging from 0.4-0.5kb of *M. rosenbergii* genome in order to screen the library with GT and CT repeats as probes. First round screening of about 1000 white colonies resulted in

as much as 3% recombinants containing microsatellites. Colonies with strong signals in the colony hybridization were considered for DNA isolation and sequencing. DNA sequencing of 15 clones done so far showed long stretches of AC/AG repeats. Twelve loci were deposited in Gene Bank with accession number from EU847612 to EU847623.

In order to explore the possibility of using microsatellite markers in parentage analysis in selectively bred Jayanti rohu and to study line-specific allele segregation, DNA from 83 parents has been isolated and quantified. Genotyping of these samples has been performed initially with 6 fluorescence labeled primers, which indicated a decrease in number of alleles as compared to farm controls. DNA isolation from 20 individuals of each family is in progress along with genotyping with more microsatellite loci.

To check informativeness of rohu microsatellite loci, 74 microsatellite markers so far available in rohu were genotyped in parents of a rohu x kalbasu backcross linkage mapping panel (49 individuals). More than forty out of 74 were found to be informative and rest monomorphic when analysed through 3% agarose and 6% PAGE. Genotyping of test mapping panel (49 individuals) has been accomplished for more than 20 loci so far for linkage analysis.

Project Title : Genetic upgradation of freshwater fish and shellfish

Funding Agency : Institute-based

Project code : I-59

Sub-project (c) : Studies on gene expression of (i) Vitellogenin and (ii) PUFA synthesizing enzymes in rohu

Duration : April 2007 - March 2009

Project Personnel : J. Mohanty (PI), S. Nandi and P. K. Mukhopadhyay

Vitellogenin synthesis was induced in rohu by hormone, estradiol (E₂) injection and the serum

collected was preserved at -20°C. Vitellogenin was purified from the induced serum by selective precipitation followed by gel filtration chromatography. The purified sample showed only one band in native gradient PAGE indicating purity of the vitellogenin.

RNA was isolated from the rohu liver and converted to cDNA using MMLV-RT. Three primer sets used for catla were tried for amplification for the partial cDNA fragments for rohu vitellogenin. The fragments (739, 718 & 740 bp) were cloned in pGEM-T easy vector and sequenced (ABI 310). BLASTing revealed that rohu Vg fragments showed an overall 93% and 91% maximum identity at the nucleotide and amino acid level respectively, with C. carpio Vg sequences. The rohu Vg sequences were submitted in the Genbank database of NCBI. Although the primer regions were conserved, some differences could be observed between rohu and catla vitellogenin both at the nucleotide and deduced amino acid sequences.

Presence of PUFA synthesizing enzymes transcript in rohu confirmed

EPA (20:5n-3) and DHA (22:6n-3) are the n-3 polyunsaturated fatty acids (PUFA) very essential for human health and predominantly derived from fishes. There is a chain of reactions catalyzed by several microsomal enzymes (i.e. delta-6 desaturase and elongase), which convert dietary linolenic acid (18:3n-3) into EPA and DHA and has been reported in many species including freshwater teleosts. EPA and DHA content in the muscle and eggs of rohu have been reported and are quite lower than marine and temperate species. To initiate the investigation, the respective primers were designed and the partial cDNA fragments of the two essential enzymes, delta-6 desaturase and long chain PUFA elongase were amplified from the rohu liver RNA (Fig. 20). The fragments were cloned in pGEM-T easy vector and sequenced. The sequence BLAST revealed that rohu desaturase bears a maximum of 93% & 92% and 97% & 93% identity at the nucleotide and protein level with C.idella and C.carpio, respectively. Similarly, the rohu elongase also showed the highest identity of 91% and 94% at the

nucleotide and protein level with the same enzyme sequence of D. rario. Both rohu sequences were submitted in the Genbank database of NCBI under the accession nos. EF634246 (delta-6 desaturase) and EU182581 (elongase).

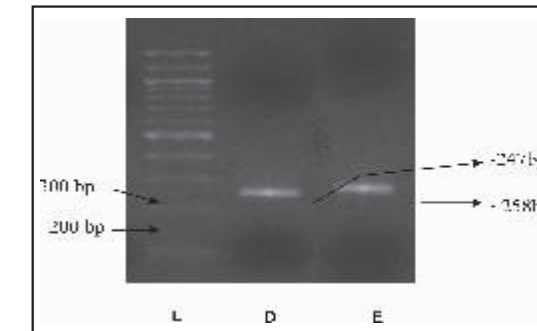


Fig 20. PCR product of rohu liver cDNA amplified with 6-desaturase and elongase specific primers. Lanes (L), 100 bp DNA ladder; (D), Desaturase; (E) Elongase.

Project Title : Genetic upgradation of freshwater fish and shellfish

Funding Agency : Institute-based

Project code : I-59

Sub-project (d) : In vitro culture of stem cell of freshwater fishes

Duration : April 2007 - March 2009

Project Personnel : H. K. Barman (PI)

Spermatogonial stem cell (SSC) technology could be useful in generating fish transgenics since SSCs are the only adult stem cells capable of germ-line transmission. These cells could also be resourceful for gene targeting as an alternate to

somatic or Embryonic stem (ES) cells especially in fish species from which no ES cells for targeting could be made possible as yet despite several attempts.

In an attempt to culture rohu (Labeo rohita) and catla (Catla catla) testicular germ cells in vitro, media, growth factors and culture conditions supportive of propagating male germ cells for about one year were formulated. The cells were stable but showed growth-factor dependent proliferation, phenotype and gene expression pattern of spermatogonial stem cells. The temperature requirement for SSC culture in vitro was optimized at 28C in a media formulation containing L-15, FBS, carp serum and other growth factors (Fig. 21). Notably, glial cell-line derived neurophilic factor (GDNF) as an extrinsic driver was evaluated which showed that GDNF indeed helps to maintain and self-renew SSCs (Fig. 22). The study opens up opportunity to study and recapitulate spermatogenesis in vitro inclusive of germ-line genetic manipulation.

Excel File Required

Fig. 22. Positive effect of GDNF on self-renewal and proliferation of SSCs

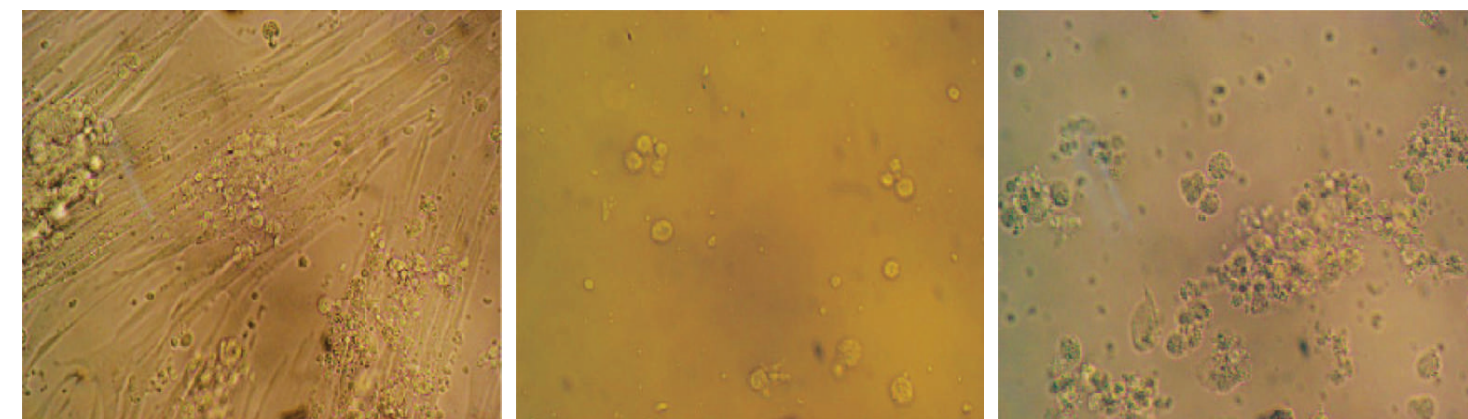


Fig. 21. In vitro proliferation of spermatogonial stem cells (SSCs) of Catla catla. A. primary culture of catla testis containing background cells. B. Background cells were eliminated after several rounds of subculture. C. Clumps of cells grown as SSC clones after about six months

Project Title : Vitellogenin and its molecular expression in catla

Project Code : E-26

Duration : November,2004-February,2008

Funding Agency : ICARAP Cess Fund Scheme

Project Personnel : S. Nandi (PI), J. Mohanty, P. Das and A. Barat

A total of 3078 bp cDNA sequence out of ~4.5 kbp of catla vitellogenin cDNA has been delineated from the 5'end which represented the N terminal amino acid sequence of the protein. The sequence was analyzed and a phylogenetic tree was made from the amino acid sequences along with the sequences of vitellogenins from other species using MEGA software (Fig. 23). It showed that amphibian vitellogenin was more closer to avian rather than with the fish. Further, catla vitellogenin appeared along with other carps in the same cluster.

C. Fish Nutrition and Physiology

Project Title : Feed formulation for nutritional responses in selected freshwater fish

Project Code : I-52

Duration : April 2005 - March 2009 (extension for 1 year)

Funding Agency : Institute-based

Project Personnel : S. N. Mohanty (PI), A. K. Datta, M. R. Raghunath, B. N. Paul, S. S. Giri, N. Sridhar and S. Sarkar

Sub-project (a) : Low cost feed formulation and feeding of improved carp

Feed development for improved rohu

Comparative evaluation of semi purified diets containing 4, 6, 8 and 10 percent lipid using casein, gelatin, and dextrin, carboxy methyl cellulose, alpha cellulose, cod liver oil, vegetable oil, vitamin and minerals was carried out in the indoor experiments to determine the lipid

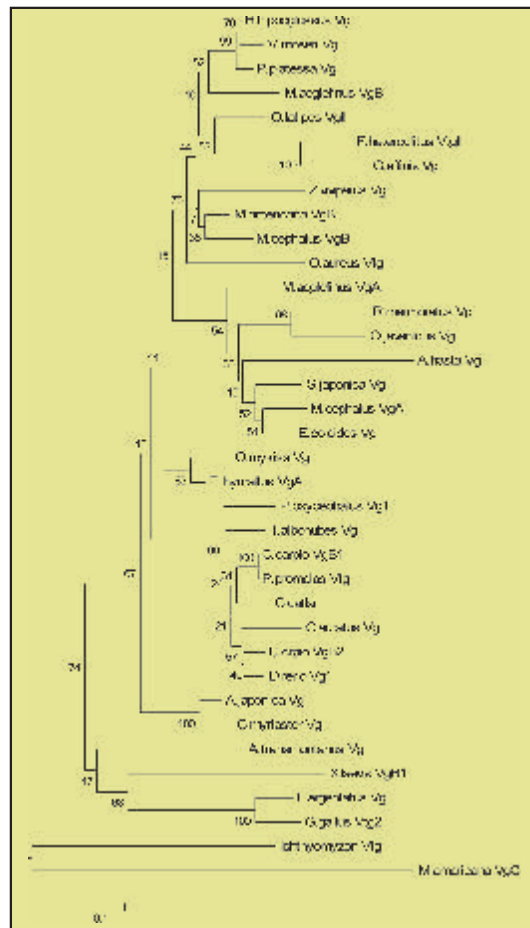


Fig 23. Phylogenetic tree made from Vg sequences (amino acid) of different species

requirement of Jayanti rohu fingerlings (13-14.5 g) and to compare with performances of normal rohu.

The carcass protein (CP) and lipid were found to be 69.89-71.4% and 13.84-14.91% in 8% lipid diet and 69.52-69.80% and 12.88-14.00% in 10% lipid diet, respectively. The corresponding values for 4

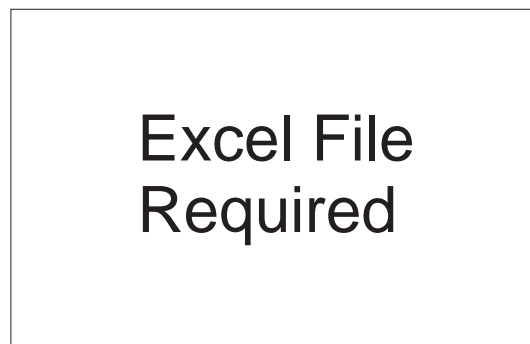


Fig. 24. Growth performance of Jayanti rohu fingerlings fed with different level of lipids



and 6% lipid diet groups were 67.5 - 68.22% and 12.12-13.22% and 68.5-69.4 and 12.5-14.2%, respectively. However, in this study 8% lipid in the diet was found optimum for good growth.

Pond evaluation of practical diets

Two diets containing 20 and 25% CP using GOC, rice bran, soybean meal, fish meal, vitamins and minerals for pond rearing of normal and Jayanti rohu in conjunction with natural food supply to study in pond condition, the growth superiority and carcass proximate composition in monoculture system were tested. The size of the pond was 0.06-0.08 ha with stocking density 5000/ha. Diets containing 25% CP was found to be better as compared to 20% CP in terms of growth performance feed conversion (Fig. 25).

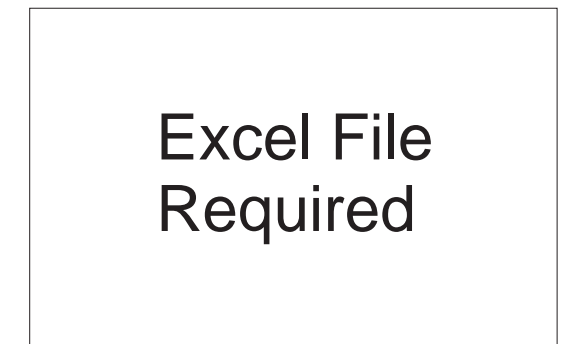


Fig. 25. FCR values of Jayanti rohu and normal rohu fed 20 and 25% CP diet

Sub-project (b) : Feed formulation and feeding of Clarias batrachus and Horabagrus catfishes

Evaluation of viscera silage in fish feed

Experiment was conducted to study the efficacy of fish and chicken viscera silage as fish meal substitute in the diet of Clarias batrachus. For the purpose five diets were prepared in which 0, 25, 50, 75 and 100% dietary fish meal replaced with

mixed silage. The mixed silage was prepared by mixing fish and chicken viscera silage at a ratio of 1:1. Other ingredients in the diets were groundnut oil cake as plant protein source, maize, oil, carboxy methyl cellulose, vitamin and mineral mixture. Carboxy methyl cellulose was used as a binder. Five diets were formulated to contain about 37 % crude protein. Maize was cooked for 30 minutes. All the major ingredients were mixed thoroughly and fortified with mineral and vitamin mixture and made in to dough. A meat mincer with a 2 mm-diameter was used for pellet preparation. The extruded pellets were dried and stored frozen.

It was observed that replacement of fish meal by silage did not reduce the apparent protein, lipid, OM, DM and carbohydrate digestibility of C. batrachus juveniles (av. body wt. 8 g).

Preparation of co-dried product with slaughter house blood silage

The fermented product was co-dried with rice bran, groundnut oil cake, maize flour and wheat flour either in hot air oven or in sunlight. Results indicated that the co-dried product with starch sources became very hard while drying in hot air oven. The product when co-dried in sunlight was soft and could be made into powder with little effort.

Feeds were formulated with supplementation of fermented slaughter house blood at 0, 25, 50, 75 and 100% level, as substitute to fish meal. Feeds were given to H. brachysoma fingerlings for 60 days feeding. Results indicated that dietary fish meal can completely be replaced by fermented blood in yellow catfish diet, without influencing growth and carcass composition. Complete replacement of fish meal from the diets is possible with supplementation of fermented blood.

Sub-project (c) : Feed development for Ompak pabda and *Mystus seenghala*

Behavior of *O. pabda* towards artificial feeding (work done at RRC, Rahara)

Preliminary study on the growth of *O. pabda* fingerlings (12.68 g) fed with 30, 35 & 40% purified protein diets reveal that the fish accepts initially all three-protein diets. But after few hours they are found to eject almost 50% of the feed consumed. The larger ones out compete the smaller or weaker ones for feed and causes damage to body including fins. However, among the three protein diets, the diet containing 35 and 40% protein induced better growth.

Sub-project (d) : Feed development of important minor carps

In separate experiments, five different purified diets containing 2, 4, 6 & 8% lipids and 12, 18, 24 & 30% carbohydrates were formulated and evaluated to assess the lipid and carbohydrate requirements of *Labeo bata* (2.53-2.87 g). Casein, gelatin, dextrin, carboxymethyl cellulose, mineral & vegetable oil in various proportion were used in the diets and the feeding results reveal that the fish has the dietary requirement of 8% lipid and 24% carbohydrate. Lipid requirement of *Labeo bata*: Five different purified diets containing 2, 4, 6 & 8% lipids and 12, 18, 24 & 30% carbohydrates were evaluated in *L. bata* (2.87 g). The experiment revealed that the fish has the dietary requirement of 8% lipid and 24% carbohydrates.

Sub-project (e) : Studies on feed development for medium carps of peninsular region

Feed development for medium carps of peninsular region

Five feeds with a narrowed down combination of soybean meal and silk worm pupae as protein sources were fed to fingerlings of *Labeo fimbriatus* and *L. rohita* for a period of 30 days. Growth parameters were measured at the end of experiment and gut samples were collected for

assay of enzyme activity. Amylase, total protease, trypsin and chymotrypsin activities have been determined (Figs. 26 & 27). The A/P ratio was found to approach the value of 1 (Fig. 28), when the FCR was minimum and the weight gain was maximum in fingerlings of *L. rohita* (Fig. 29). The T/C ratio was found to be maximum in the groups that exhibited low FCR and maximum weight gain.

Feeding with protein from different sources (soybean meal, groundnut oil cake and silkworm pupae) on digestive enzymes secretion and activities in the fingerlings of *L. rohita* was studied. In a 30 days feeding study, the specific activities of each enzyme were determined. The weight gain and FCR were also determined.

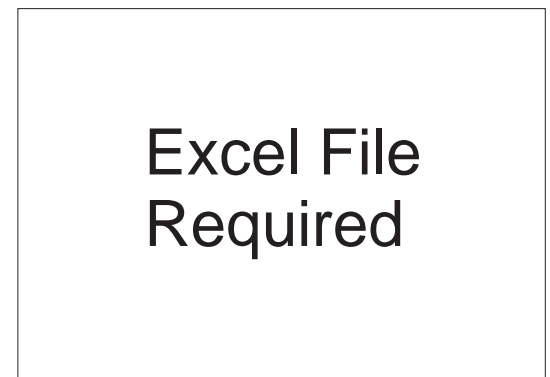


Fig. 26. Specific activities of amylase and total protease of *L. rohita*

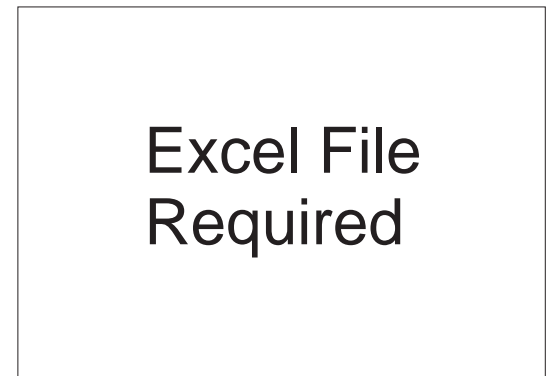


Fig. 27. Specific activities of trypsin and chymotrypsin in *L. rohita*



Fig. 28. Relationship between A/P activity ratio and feed conversion ratio in *L. rohita*



Fig. 29. Relationship between A/P activity ratio and weight gain of *L. rohita*

Project Title : Sustainable aquafeeds to maximize the health benefits of farmed fish for consumers (AquaMax)

Project Code : E-35

Duration : January,2007-February,2010

Funding Agency : European Commission

Project Personnel : S. N. Mohanty (PI) and S. S. Giri

In a ten months intensive pond rearing of Indian major carps such as catla, rohu or improved variety rohu (Jayanti) and mrigal, the substitution of fish meal and fish oil with plant protein and oil does not appear to adversely affect the growth of fish and there was a trend of comparable production with low FCR in the plant diet.

Project Title : Physiological mechanism of early maturation and multiple breeding of Indian

major carps and *Heteropneustes fossilis*

Project Code : I-51

Duration : April 2005 - March 2008

Funding Agency : Institute-based

Project Personnel : A. K. Pandey (PI), S. K. Sarkar and Ashis Saha

Occurrence of follicular atresia in ovary of *H. fossilis*

Since oocytes in different stages of growth and differentiation are lost through atresia affecting the fecundity or reproductive potential of the fish, an attempt was made to record the incidence of follicular atresia in ovary of *H. fossilis*. In the catfish, remnants of atretic follicles in the form of nodule of stroma tissue were observed even in the immature ovaries during December-January. Some previtellogenic atretic follicles of *H. fossilis* during March-April exhibited prominent granulosa cells, separation of ooplasm from zona pellucida and disorganization of ooplasm. Vitellogenic ovarian follicles of the catfish at early stage of atresia (May-June) showed prominent granulosa cells, vacuolation of the ooplasm at periphery and ooplasm giving flocculent appearance. During the advanced stage of atresia (September-October), the oocytes of the catfish depicted disorganized ooplasm, obscure germinal vesicle and hypertrophied granulosa cells. Phagocytic invading of granulosa cells in zona pellucida and ooplasm were also prominent.

Effect of HCG and WOVA-FH administration on follicular atresia of catfish

An attempt was made to record the effect of intramuscular HCG (25 IU and 50 IU/kg body weight) and WOVA-FH (0.2 ml/kg body weight) administration for 4 weeks (28 days) on the incidence of follicular atresia of *H. fossilis*. Atretic follicles were noticed in the ovary of the catfish even during early maturation, matured and spawning phases of the ovarian development though they were more predominant during post-spawning (spent) phase. Low doses of HCG (25 and

50 IU/kg body weight) and WOVA-FH (0.2 ml/kg body weight) administration reduced the incidence of follicular atresia to the extent of 26-31% in captive stock of the catfish, suggesting the follicular atresia is due to insufficient secretion of the hormone from pituitary gland.

Occurrence of vesicles in the pituitary gland of *H. fossilis*

Pituitary glands of 138 specimens of female *H. fossilis* were examined to record the correlative seasonal changes in the cynophil cells (gonadotrophs) with the ovarian maturation. Rare occurrence of the hypophysial vesicle was recorded in two specimens of maturing catfish. These vesicles are assumed to be a primitive character that might be having some significance in the evolution of pituitary gland in teleosts.

Effects of carbamate pesticides on hypothalamo-neurosecretory system of *Channa punctatus*

Since hypothalamic neurohormones regulate the reproductive physiology of teleosts by modulating the hypophysial functions, an attempt was made to record the effect of carbamate pesticides on hypothalamo-neurosecretory system of *Channa punctatus*. Fishes were exposed to sublethal concentration of Carbaryl (5.20 mg l⁻¹; 30% LC₅₀ for 96 h) and Cartap (0.18 mg l⁻¹, 30% LC₅₀ for 96 h) for 96 hours. Sublethal exposure of Carbaryl and Cartap induced hypertrophy of the neurosecretory cells of both nucleus preopticus (NPO) and nucleus lateralis tuberis (NLT) at 24 hours, followed by loss of staining affinity at 48 as well as varying degrees of cytoplasmic vacuolization and necrosis by 72 and 96 hours of exposure. Herring bodies (HB) were also encountered in the neurohypophysis of the murels at 96 hours of the treatment.

Project Title : Differential hormonal gene expression during reproduction in Indian major carp, *Labeo rohita*

Project Code : I-53

Duration : April 2006 - March 2009

Funding Agency : Institute-based

Project Personnel : S. K. Sarkar (PI), P. K. Nayak (from CRRI), S. Nandi, P. Das, Ashis Saha and S. Dasgupta

Amplification and characterization of full-length cDNAs of rohu GTH sequences

Primers were designed to amplify the full length coding sequences of both GTH-I and II beta subunits, which produced 374 bp and 436 bp products, respectively from the mature rohu pituitary cDNA (Fig. 30). The amplified fragments were cloned and sequenced in pGEMT-vector. The sequences were BLASTed in the NCBI database which showed the identity percentage of 90 and above with the GTH-I and II sequences of other carps (Fig. 31a,b). These nucleotide sequences represented 5-127th and 1-143rd amino acid sequences of GTH I and II respectively of *Ctenopharyngodon idella*.

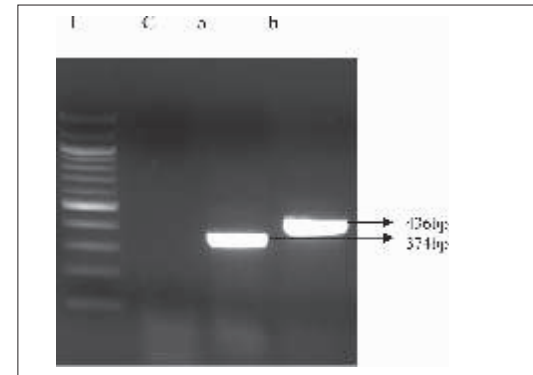


Fig. 30. RT-PCR amplification of full-length cDNA of GTHs (I and II) beta from rohu pituitary RNA, L- Ladder, C-Control, a-GTH-I, b-GTH-II

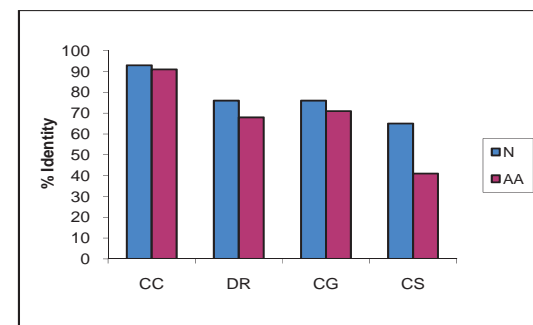


Fig 31a. Identity of GTH-I of rohu with different fish species

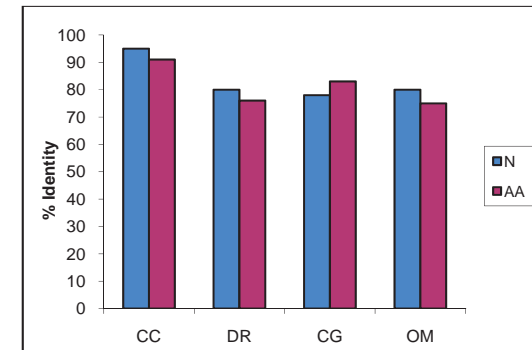


Fig. 31b. Identity of GTH-II of rohu with different fish species

N: Nucleotide, AA: Amino acid, CC: *Cyprinus carpio*, DR: *Danio rario*, CG: *Clarias gariepinus*, CS: *Chum salmon*, OM: *Oncorhynchus mykiss*

Project Title : Photothermal manipulation on neuroendocrine regulated reproduction in carp, *Labeo rohita* under controlled environment

Project Code : I-61

Duration : April 2007 - March 2010

Funding Agency : Institute-based

Project Personnel : S. K. Sarkar (PI), Ashis Saha, S. Nandi, P. Routray, J. Mohanty, N. Sarangi, S. Dasgupta and D. K. Verma

Indian major carp rohu (*Labeo rohita*) and catla (*Catla catla*) has been bred during winter season and successfully produced spawn (seed) at carp hatchery, CIFA for the first time in India under controlled conditions manipulating environmental cues to advance gonadal maturation. Rohu was bred on 24 January, 9 February and 12 March, 2008 and catla on 26 February, 2008. The breeding season of carps in India generally commences from May to August depending on the onset of monsoon. Therefore, suitable size of fish fingerlings (80-100 mm) for grow out culture is normally available to the farmers earliest by September. The present breakthrough would enable the farmers to have the fingerlings by May for stocking in their ponds and reservoirs and utilize at least five more months as the growing period under suitable environmental conditions for fast growth during April to October. The success of the present experiment opens up the future possibility of breeding and seed production of carps round the year.



Mature rohu female ready for breeding during the month of January 2008



Mature catla female ready for breeding during the month of January 2008



D. Fish Health Management

Project Title : Development of primary cell culture derived from carp fin, liver, kidney and prawn larvae

Project Code : I-50

Duration : April 2005 - March 2008

Funding Agency : Institute-based

Project Personnel : N. K. Maiti (PI), S. K. Swain, J. Mohanty, P. Swain and S. Mohanty

Effect of organophosphorus compound on cell culture

Spleen was removed aseptically from common carp. Organ was minced finely, forced through syringe and larger tissues were allowed to settle, supernatant collected, centrifuged and suspended in RPMI medium containing 20% FCS. After 48 h medium was discarded and cells received methyl parathion, at 100, 200, 800 ng/ml and 1 µg/ml of RPMI having 2% FCS and incubated at 28 C. Before appearance of any visible changes, cells were harvested and subjected to RNA extraction and 1st strand cDNA was synthesized by MMLVRT. Normalization of amount of RNA in different samples carried out using β -actin primer. PCR was carried out using TGF- β primers at an annealing temperature of 55 C.

PCR products were separated in 2% agarose gel. After spot densitometry it was found that methyl parathion cause immunosuppression as a result TGF- β is upregulated and seems to be a potent gene to monitor environmental pollutants particularly organophosphorus compounds.

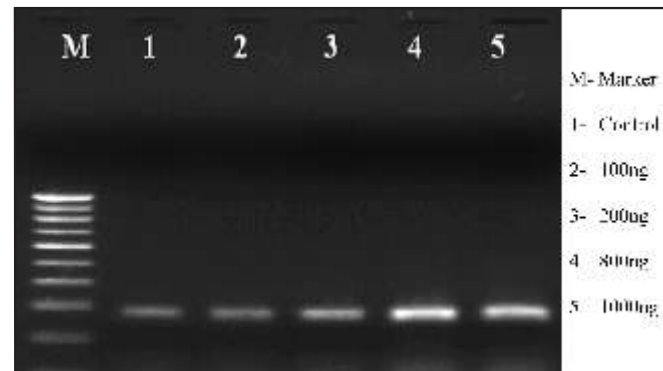


Fig. 32. PCR showing TGF β amplification in different treated samples of common carp

Table 24. Results of spot densitometry of common carp

Sample	IDV	Area	Average
Control	66634	189	54
100 ng	67730	1189	57
200 ng	80852	1189	68
800 ng	108199	1189	91
1µg	99876	1189	84

IDV- Integrated Density Value; AREA- Region enclosed by BOX; AVG- Average Value After back Ground correction



X- axis value in ng/ml
Y- axis value in ng/10µl

Fig. 33. Graphical representation of TGF- expression in different treated samples of common carp

Project Title : Application of Microorganisms in Agriculture and allied sectors

Project Code : E-37

Duration : April, 2006 - March, 2008

Funding Agency : NBAIM, Mau

Project Personnel : N. K. Maiti (PI) and S. Mohanty

From the 41 positive cellulolytic bacteria genomic DNA was extracted and checked followed by quantification was carried out spectrophotometrically. In order to reveal the difference in the PCR-RFLP of 16S rDNA, genomic DNA from all the isolates was used as template for PCR amplification of 16S rDNA. A specific product of 1.5 kb was obtained in all the isolates. The amplified PCR product was digested with three restriction enzymes viz; Alu I, Hae III and Msp I. 16S PCR product digested with Alu I shows one common band of molecular size 184bp, Hae III digestion produced three common bands of molecular size 435, 294 and 123 bp and banding pattern obtained with Msp I shows three common bands of 422, 220 and 132bp molecular size (Fig.34). Five different profiles were obtained with PCR products digested with Alu I, four with Hae III and twelve with Msp I. Patterns of each

enzyme were combined together and each strain was assigned a composite genotype (Table. 25). Based on this, 15 genotypes were obtained. Dendrogram (Fig. 35) was constructed using the 16s r DNA RFLP showed seven different clusters at 80% similarity level. This study shows that PCR-RFLP of 16s rDNA could be successfully applied to access the genetic relationship of different Bacillus species.

Table 25. Genotyping of the cellulolytic Bacillus species

Composite genotype	No. of strains
AAB	5 (C7E, C5K, C8P, C14A, C14N)
AAC	1 (C8N)
AAE	1 (C5M)
AAI	1 (C5R)
BBD	9 (C9E, C11E, C12C, C12I, C12L, C9EP, C12IP, C5A, C5F)
BBJ	2 (C1H, C11C)
BDH	1 (C14K)
CAA	10 (C2B, C3F, C7A, C11A, C11B1, C11B2, C8K1, C8K3, C14J, C14E)
CAC	2 (C6C, C11D)
CAF	1 (C2F)
CAK	3 (C10F, C14L, C14D)
CAL	1 (C13A)
CBK	1 (C8M)
DAA	2 (C1G, C3E)
ECG	1 (C4B)

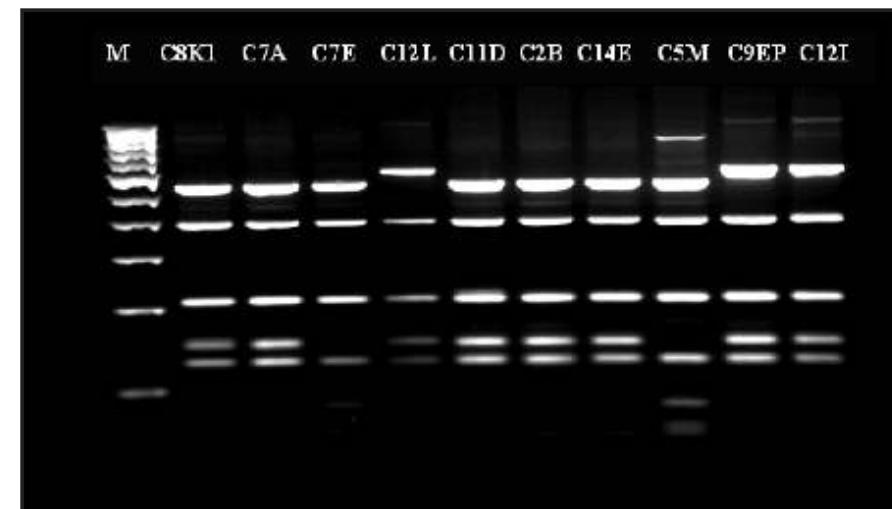


Fig. 34. Agarose gel electrophoresis of Msp I digested PCR product. Lane 1, size marker (100 bp ladder), lanes 2-10 sediment isolates.

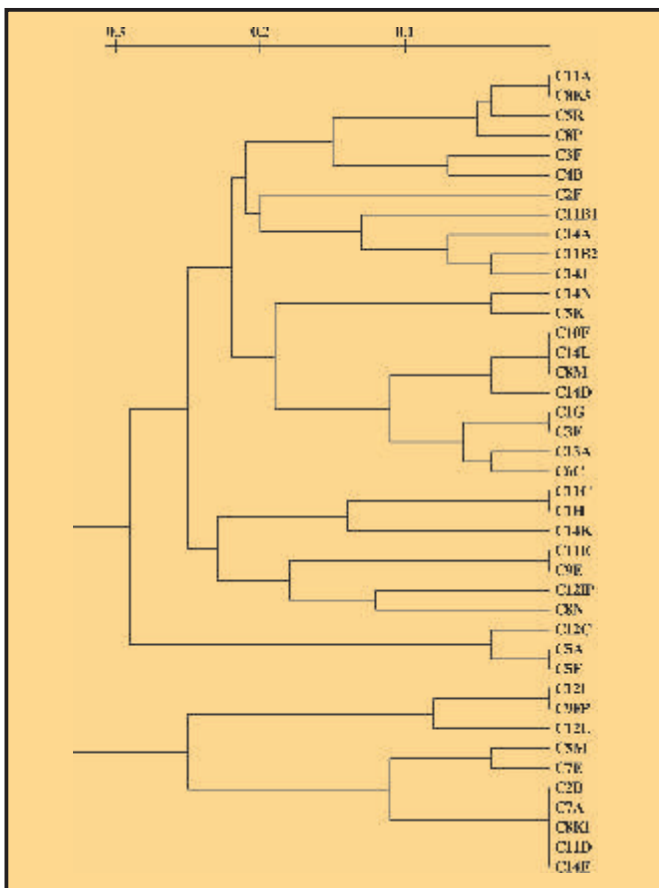


Fig: 35. Dendrogram showing the genetic relationship of different Isolates of cellulolytic Bacillus sp. constructed on the basis of 16s RFLP

Project Title : Investigation of efficacy of commercial lactic acid bacteria as freshwater fish/shellfish probiotics

Project Code : I-58

Duration : April, 2007 - March, 2010

Funding Agency : Institute-based

Project Personnel : S. Mohanty (PI), P. K. Sahoo, N. K. Maiti, B. C. Mohapatra and S. K. Sahu

Food grade lactic acid bacteria (16 nos) were collected from different sources to study the efficacy of such bacteria as fish probiotics against Aeromonas hydrophila. All sixteen isolates were screened through different tests like agar well diffusion test, disc diffusion test, agar spot test and ability to grow in co-culture with the

pathogen. Three selected strains were administered to Clarias batrachus with formulated feed for a period of 15 and 30 days. The challenge study showed the probiotic fed fish showed greater resistance to injected Aeromonas hydrophila than the control. Also immuno parameters like myeloperoxidase activity, ceruloplasmin activity and antiprotease activity was better in comparison to control samples. The initial results indicate, possibility of such bacteria as feed probiotics in aquaculture.

Project Title :

Studies on association of viral infections in diseases of koi carps by immunological and molecular techniques

Project Code : E-39

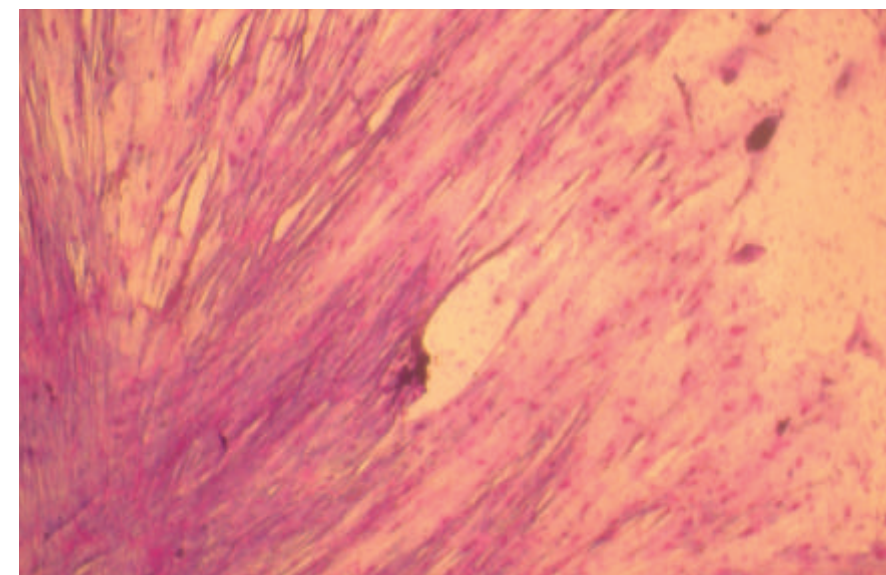
Duration : December, 2006 - December, 2009

Funding Agency : DBT, Govt, India

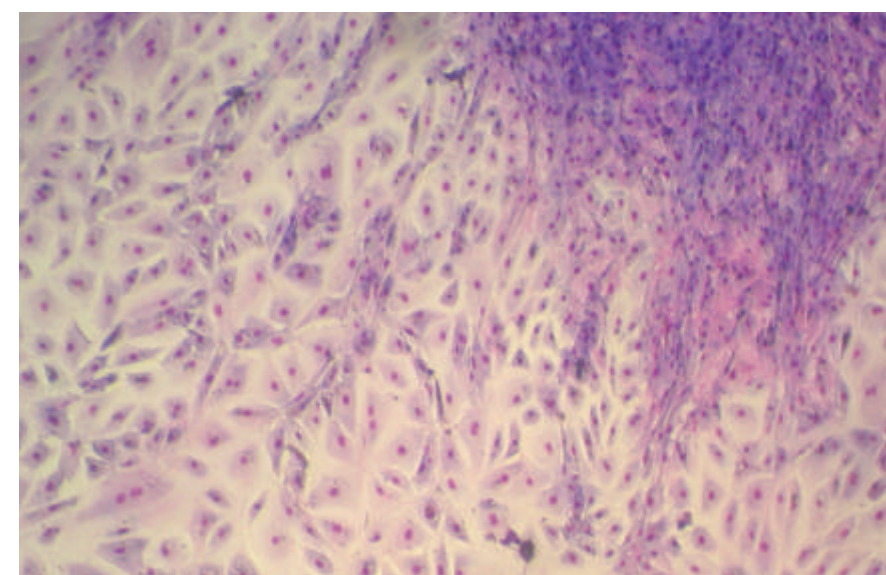
Project Personnel : Priyabrat Swain (PI), N. K. Maiti, B. K. Mishra and S. K. Swain

Preparation and characterization of primary cell cultures from different cultivable tissues of koi carps for virus isolation

Explant culture of tissues like heart, liver and testis from koi carp showed good attachment, proliferation and growth. The heart and liver cells exhibited both epitheloid and fibroblastic growth and survived up to 4th passage and 5th passage respectively in Dulbecco's minimum essential medium (DMEM) media with fetal calf serum (FCS). Heart cells survived up to 6th passage and liver continued till 5th passage in DMEM media with goat serum. Testis exhibited fibroblastic growth and could only survive till 3rd passage when cultured in DMEM media with FCS.



Confluent monolayer of liver cells comprising fibroblast like cells (x100, Giemsa staining), 5th day of 4th passage

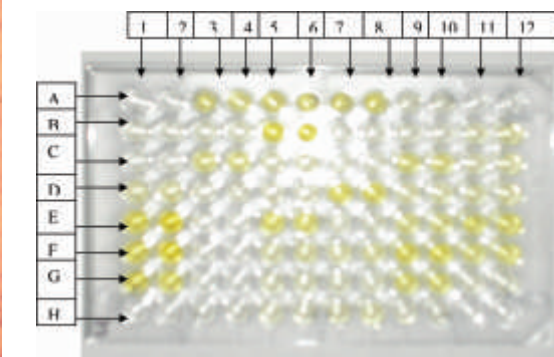


Confluent monolayer of heart cells comprising epithelial like cells (x100, Giemsa staining) (6th day of 3rd passage)

Detection of KHV antibodies in Koi serum samples

Out of 78 serum samples of koi carp examined by Avidin-Biotin ELISA, 23 were positive for anti-KHV antibodies (Fig 36). The fishes, those showed optical density value of approximately 0.18 and above were considered as a strong positive for KHV. These suspected fishes were sacrificed and their tissues and organ such as kidney, gill, spleen,

liver, intestine, fin, heart and skin were collected and preserved at -20° C. These tissues and organs were used for passaging in KF cell lines and examination by PCR. However, screening of these samples by PCR for KHV was found to be negative.



Blank: A1-A4
Positive control: B1- B2 & C1-C2,
Negative control: B3-B4 & C3-C4
Wells having positive samples: B9-B10, C9-C10, C-11-C-12
D5 -D6, D9-D10, E7- E8, F3-F4, F9-F10, G5-G6, H3-H4, H5-H6, H7-H8.

Fig. 36. Avidin-Biotin ELISA showing positive reactions

Project Title : Isolation, Identification and characterization of active components from amoebocytes of horseshoe crab for developing suitable diagnostics

Duration : May, 2006 - April, 2009

Funding Agency : DST Fast Track Scheme, Govt. of India

Project Personnel : S. K. Nayak (PI) and P. Swain (Mentor Scientist)

Immunostimulatory effect of the amoebocytes lysate and plasma of Indian horseshoe crab, Tachypleus gigas in indian major carp, Labeo rohita

The immunostimulatory properties of amoebocytes lysate and plasma of the Indian horseshoe crab Tachypleus gigas, the species that contains a wide range of antimicrobial and biologically active substances in its circulating haemolymph were studied in L. rohita. L. rohita yearlings of weight ranging from 80-100 g in separate groups were injected intraperitoneally

with amoebocytes lysate and plasma containing 50 and 100 µg protein. Among different blood/serum immune parameters, protein, globulin, respiratory burst activity and myeloperoxidase activity were found to be significantly high ($p < 0.01$) in 50 µg lysate and 100 µg plasma protein injected groups (Figs. 37 & 38). The lysozyme level was high in lysate injected groups at both the concentrations (Fig. 39). The bacterial agglutination titre was significantly high in the group injected with 50 µg of lysate protein (Fig. 40). The enhancement of various immune parameters as well as survival was lower in 50 µg of plasma protein injected group. On challenge with virulent *Aeromonas hydrophila*, highest percentage of survival was recorded in 50 µg lysate protein-injected group (50%) followed by 45% in both 100 µg lysate and plasma protein-injected groups.

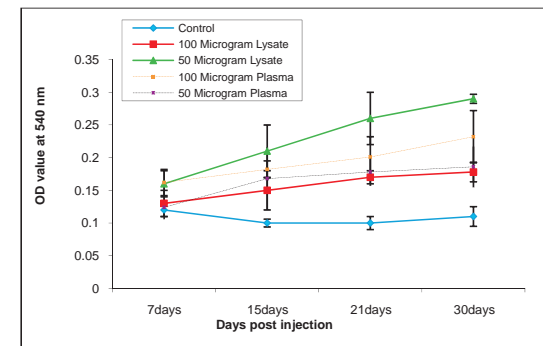


Fig. 37. The respiratory burst activity in the blood of rohu yearlings in 50 and 100 µg lysate protein injected groups after various days post injection

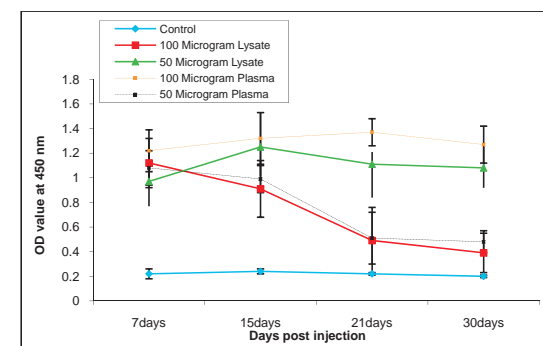


Fig. 38. The myeloperoxidase activity in the serum of rohu yearlings in 50 and 100 µg lysate protein-injected groups after various days post injection

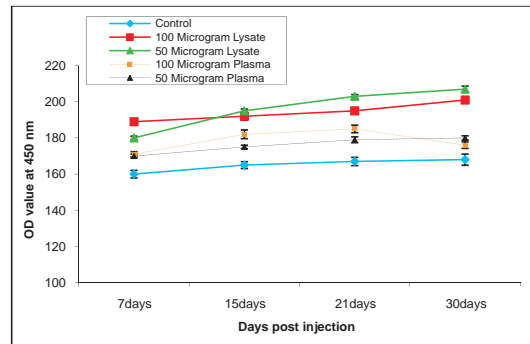


Fig. 39. The serum lysozyme level of rohu yearlings in 50 and 100 µg lysate protein-injected groups after various days post injection

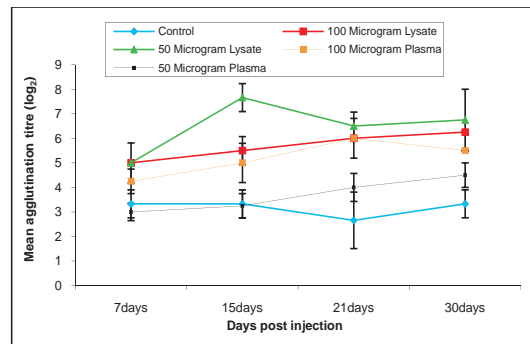


Fig. 40. The mean (\pm SD) of agglutinin titre of rohu yearlings in 50 and 100 µg lysate protein-injected groups after various days post injection

Effect of endotoxin on the immunity of Indian major carp, *Labeo rohita*

Rohu yearlings of weight ranging from 80-100 g were injected intraperitoneally with 0.5, 1, 2, 5, 10 and 20 EU/fish dose of endotoxin and found to resist the endotoxin dose up to 20 EU/fish. However, at the lower doses i.e., at 0.5 to 2.0 EU/fish; it acted as an immune potentiator. Different serum and immune parameters like protein, globulin, lysozyme, respiratory burst activity, myeloperoxidase activity, natural agglutination titre were found to be significantly high ($p < 0.01$) at dose of 1 EU/fish (Figs. 41 & 42). While at 10 and 20 EU/ fish, most of these parameters were lower thereby indicating the immunosuppressive nature of the endotoxin at these higher doses.

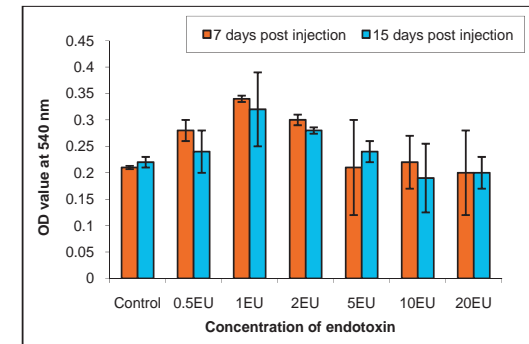


Fig. 41. Effect of different doses of endotoxin on the serum myeloperoxidase activity of *L. rohita* yearlings after 7 and 15 days post-injection

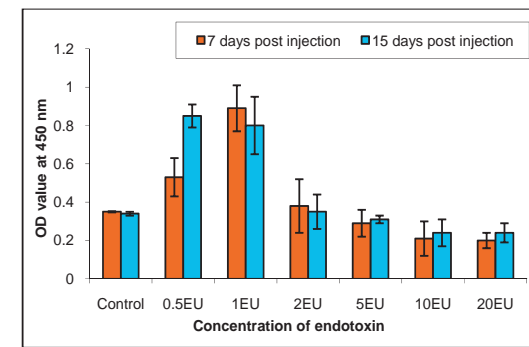


Fig. 42. Effect of different doses of endotoxin on the blood phagocytic respiratory burst activity of *L. rohita* yearlings after 7 and 15 days post-injection

Endotoxin binding activity of the amoebocyte lysate of Indian horseshoe crab, *T. gigas*

The crude, chloroform and toluene extracted amoebocytes lysate of Indian horseshoe crab bound differently to the endotoxin. The crude lysate was found to bind endotoxin 10 EU/ml and partially to 5 EU/ml. The toluene and chloroform extracted lysate bound up to 2.5 EU/ml while the commercially available LAL lysate detect up to 0.06 EU/ml (Table 26).

Table 26. The gel formation pattern of crude and organic solvent extracts of the amoebocytes lysate of Indian horseshoe crab, *T. gigas* against *E. coli* endotoxin

	20 EU/ml	10 EU/ml	5 EU/ml	2.5 EU/ml	0.25 EU/ml	0.6 EU/ml	0.06 EU/ml	0.03 EU/ml
Commercial Lal kit	++++	++++	++++	++++	++++	++++	+++	+/-
Crude lysate	++++	++	+/-	-	-	-	-	-
Toluene extracted	++++	++	++	++	-	-	-	-
Choloroform extracted	++++	++	++	++	-	-	-	-

++++: Complete gel formation, +++ : Weak gel formation, ++ : Partial gel formation, +/- : Slight or no gel formation

Project Title : Immune responses in carps with particular reference to immune related genes

Project Code : I-57

Duration : April 2007 - March 2010

Sub-project (a) : Cloning and sequencing of interferon inducible genes of *Labeo rohita*

Funding Agency : Institute-based

Project Personnel : B. K. Das (PI), B.K. Mishra and S, Nandi

Mx protein expression was studied in *Labeo rohita* weighing 25-30 g following poly I:C injection up to the 14th day. Blood and organs (gill, kidney and liver) were collected from rohu and the expression of Mx protein was detected by different methods.

Dot-Blot of plasma and tissues

The staining intensity of plasma samples on NCP were increased from day 2 to day 4 and subsequently decreased up to day 14 in case of treated fish as compared to the control fish (Fig. 43).

Excel File Required

Fig. 43. Graphical representation of Dot-blot observation of plasma samples at different days

Out of the different tissues viz., kidney, liver and gill, kidney showed a higher rate of staining intensity compared to liver and gill on day 2. On day 3, all the tissues showed a good staining, out of which kidney possess a higher staining intensity, gill showed a medium staining intensity and a low intensity of colour in case of liver was observed. On day 4 the staining intensity of kidney sample was increased to a higher level but both gill and liver tissues showed a low staining intensity. Similar to day 4, on day 7, the kidney showed the highest intensity of staining but it decreased as compared to day 4. Both gill and liver showed same intensity of staining. The staining intensity of kidney reduced to a great extent as compared to other days where as gill stained more intensely (Fig. 44).

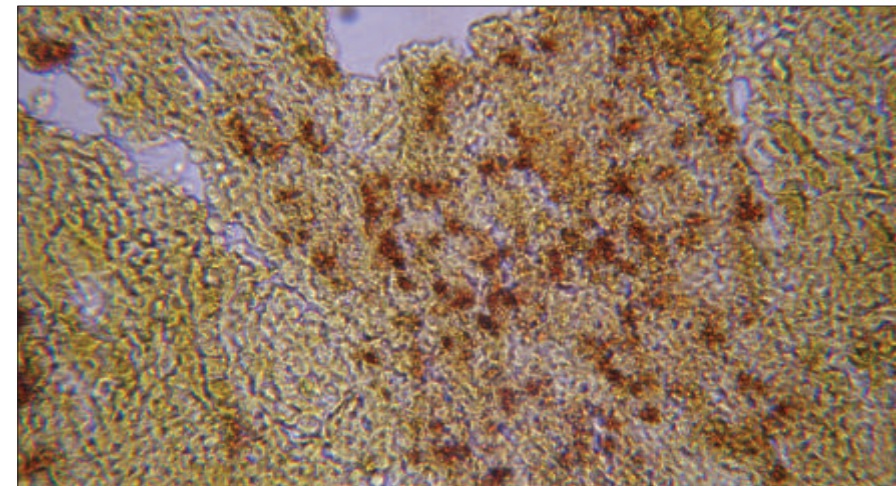
Immunostaining of Mx protein in tissues of *Labeo rohita*

The intensity of staining for Mx protein in the kidney, liver and gill of control rohu injected with PBS and stimulated rohu injected with poly I: C is summarized in Table 26.

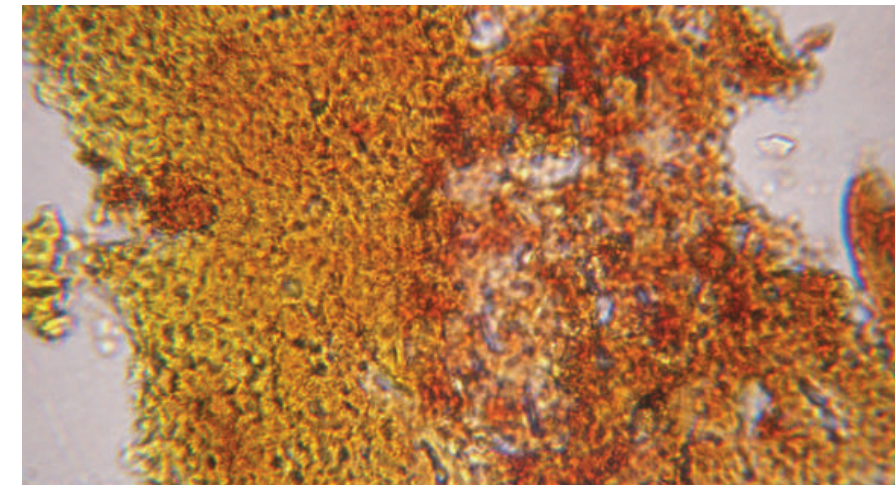
On the second day following injection, staining was very poor in the control fish, while more intense and widespread in the poly I:C injected fish. On day 3, the intensity of staining increased markedly in the control fish but only slightly in the poly I:C treated fish. The increase in staining intensity progressed till day 4. Thereafter, at days 7 and day 14, little difference was discernible between the control and poly I:C treated groups, both of which showed only slight or no staining.

Determination of protein molecular weight by SDS-PAGE and immunoblot analysis

To reveal the exact profile of the target protein, SDS-PAGE was performed by electrophoresis of the supernatants of the collected tissues of kidney, liver and gill. Similarly, plasma of the control and poly I: C injected fish was electrophoresed. To know more specifically the efficacy of the Ab, western blot of the plasma and supernatants of kidney, liver and gill were performed. It was found that one typical band corresponding to 76 kD was found in case of plasma, kidney and gill. In case of liver two bands were found (Fig. 45).



Immunostained liver sample on day3



Immunostained kidney sample of treated fish on day 2

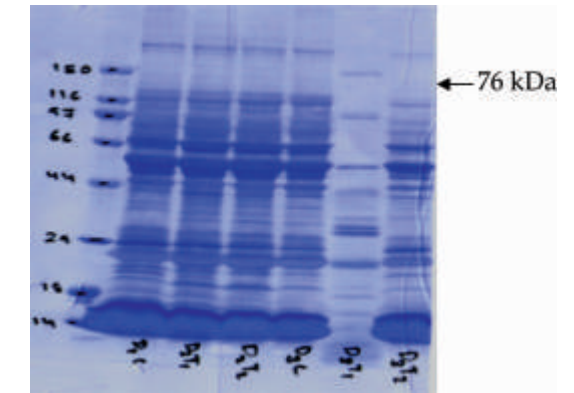


Fig. 45. SDS-PAGE of plasma samples at different days of observation

Excel File
Required

Fig. 44. Graphical representation of Dot-blot observation of different organs (gill, kidney and liver) at different days

Immunocytochemistry of blood

Smears of blood and buffy coat cells were immunoassayed for Mx protein. At day 2, both control and poly I:C injected fish showed staining of the cytoplasm in monocyte-like cells. In the poly I: C injected fish at day 2, and only at this time, in buffy coat smears but not blood smears, most erythrocytes stained strongly for Mx. This was observed when cells were stained with the Vector kit. At day 3-4, in addition to monocytes, the cytoplasm of lymphocytes stained strongly in all fish. At day 7, Mx positive lymphocytes were only found in 2/4 fish in both groups. The cytoplasmic staining of monocytes was consistently observed in all fish at all sampling times. At day 14, it was intensely stained.

Table 27. Distribution and relative abundance of Mx protein in the organs of *Labeo rohita*

Days		Fish No.	Kidney	Liver	Gill
2	Control	RC11	+	-	-
		RC12	+	+	-
		RC13	+	-	+
		RC14	-	-	-
	Poly I:C treatment	RP11	+++	+	++
		RP12	++	+	++
		RP13	++	++	++
		RP14	++	++	+
3	Control	RC15	+	+	+
		RC16	+	+	-
		RC17	+	-	-
		RC18	+	-	-
	Poly I:C treatment	RP15	+++	++++	++
		RP16	++	++	+++
		RP17	+++	+++	+++
		RP18	+++	++	++
4	Control	RC19	+	+	+
		RC20	+	-	+
		RC21	+	++	+
		RC22	-	+	-
	Poly I:C treatment	RP19	++	+	++
		RP20	++	+	++
		RP21	+++	++	+++
		RP22	+++	++	++
7	Control	RC23	-	-	-
		RC24	+	+	+
		RC25	+	+	+
		RC26	-	+	-

	Poly I:C treatment	RP23	+++	+++	+++
		RP24	+++	+++	+++
		RP25	++	+	++
		RP26	++	++	++
14	Control	RC27	-	-	+
		RC28	+	-	-
		RC29	-	-	-
		RC30	+	+	+
	Poly I:C treatment	RP27	+	+	-
		RP28	+	+	-
		RP29	-	+	-
		RP30	+	-	-

Mx protein staining intensity were evaluated visually as absent(-), present above background (+), low(++).

Project Code : I-57

Sub-project (b) : Studies on immune responses in Puntius sarana

Duration : April 2007 - March 2009

Funding Agency : Institute-based

Project Personnel : P. K. Sahoo (PI), J. Mohanty & J. K. Jena

Establishment of normal ranges and mean values of few haematological and innate immune parameters of *P. sarana*

Blood samples were collected from juveniles and sub-adults of *P. sarana* over a period of one year. The normal ranges and mean values of various haematological and innate immune parameters were estimated (Table 28).

Table 28. Normal ranges and mean values of haematological and innate immune parameters of *P. sarana* (N = number of fish sampled)

Parameter (units)	N	MEAN±SE	MIN	MAX
ACH ₅₀ (units/ml)	62	27.02 ± 1.48	7.54	54.79
Lysozyme (µg/ml)	69	3.68 ± 0.13	2.22	6.51
Myeloperoxidase (OD _{450nm})	95	0.91 ± 0.03	0.10	1.7
Antiprotease (% inhibition)	85	82.02 ± 0.57	58.45	96.70
Total protein (g/dl)	79	7.11 ± 0.37	2.42	14.65
Ceruloplasmin (units/25µl)	88	0.66 ± 0.03	0.18	2.19
NBT (OD _{540nm})	53	0.26 ± 0.01	0.01	0.48
Glucose (mg/dl)	35	58.99 ± 4.12	13.80	110.88
PCV (%)	46	28.69 ± 1.17	11	46
Hb (g %)	46	7.11 ± 0.42	1.69	12.9
TEC (10 ⁶ cells/cu. mm)	31	1.58 ± 0.14	0.5	3.56
TLC (10 ³ cells/cu. mm.)	25	35.18 ± 2.93	16.5	62.4

Sex and variation in haematological and innate immune parameters of *P. sarana*

Serum ceruloplasmin level and blood phagocytes superoxide production as well as total leucocyte count were higher in males as compared to females during breeding season of the year. Other innate immune parameters viz., serum ACH50, lysozyme, antiprotease, myeloperoxidase, total protein and haematological parameters viz., total erythrocyte count, haemoglobin, packed cell volume and blood glucose did not vary between sexes.

Seasonal variation in haematological and innate immune parameters of *P. sarana*

Most of the innate immune parameters and haematological parameters studied here showed



higher values/activity during summer season. The lowest NBT, myeloperoxidase activity and total protein level were marked during winter. ACH50 activity was lowest during rainy season whereas total protein level was the highest in this season (Table 29).

Purification and characterization of immunoglobulins of *P. sarana*

Immune sera was prepared in *Puntius sarana* by injecting bovine serum albumin (BSA) to twenty numbers of fish (150-250 g). The sera collected after immunization schedule was pooled and preserved at -20°C until use. Immunoglobulins from this pooled sera was purified by affinity chromatography on a column of BSA-Sepharose 4B. The purified Ig sample run on a native gradient PAGE, showed only a single band indicating the purity and homogeneity of the product. Further it indicates that there is only one type of Ig present in *Puntius sarana* like other teleostean species.

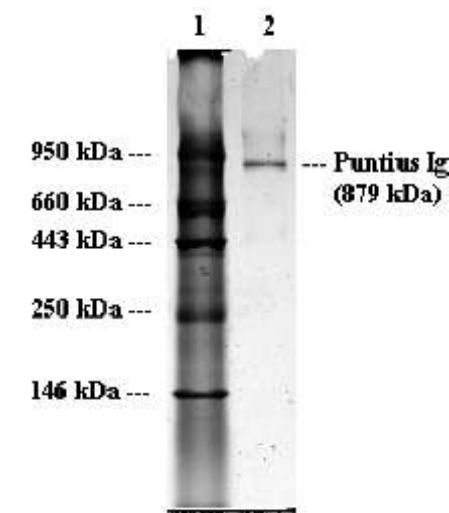


Fig. 46. Puntius immunoglobulin run in native gradient PAGE (2.8-22.5% acrylamide) (Lane 1: marker; lane 2: purified Ig)

The purified immunoglobulin molecules of *Puntius sarana* was run in native gradient PAGE of 2.8 to 22.5% acrylamide alongside known molecular weight markers. The molecular weight of the native Ig molecule was determined from four gels and found to be ~879 kD (879.39 ± 14.29, mean ± SD) (Fig. 46).

The purified *P. sarana* Ig when run on SDS-PAGE of 12% separating gel, only one type of heavy (H) and one type of light (L) chains were found. The molecular weights were calculated in comparison to the known molecular weight standards from four gels as ~88 kD (88.00 ± 0.74, mean ± SD) for H chain and ~26 kD (26.06 ± 0.35, mean ± SD) for L chain (Fig. 47).

Sequences deposited in GenBank

Puntius sarana partial mRNA for complement component C3 (C3 gene). Accession no. AM773826

Puntius sarana partial mRNA for transferrin (tf gene). Accession no. AM690342

Puntius sarana partial mRNA for beta 2-microglobulin (b2m gene). Accession no. AM690445

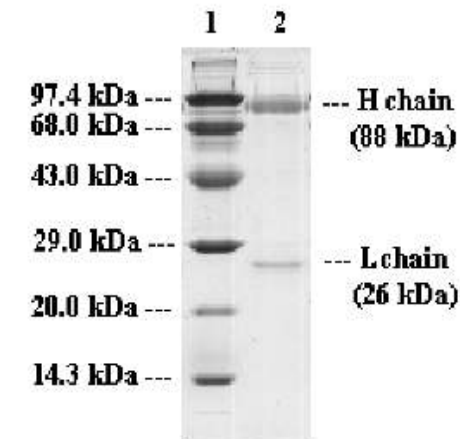


Fig. 47. Puntius immunoglobulin run in SDS-PAGE under reducing condition (Lane 1: marker; lane 2: purified Ig)

Table 29. Seasonal variation in haematological and innate immune parameters of *P. sarana*

Parameter (Units)	Season	N	Mean ± s.e
ACH ₅₀ (units/ml)	Summer	19	33.03 ± 3.21 ^b
	Rainy	16	19.27 ± 2.37 ^a
	Winter	27	27.37 ± 1.63 ^b
Lysozyme (µg/ml)	Summer	33	3.45 ± 0.13 ^a
	Rainy	16	3.94 ± 0.36 ^a
	Winter	20	3.85 ± 0.26 ^a
Myeloperoxidase (OD _{450nm})	Summer	32	1.11 ± 0.07 ^c
	Rainy	35	0.94 ± 0.046 ^b
	Winter	28	0.65 ± 0.05 ^a
Antiprotease (% inhibition)	Summer	18	82.56 ± 0.66 ^a
	Rainy	37	80.88 ± 1.10 ^a
	Winter	30	83.10 ± 0.76 ^a
Total Protein (g/dl)	Summer	29	5.73 ± 0.29 ^a
	Rainy	19	12.47 ± 0.32 ^b
	Winter	31	5.12 ± 0.20 ^a
Ceruloplasmin (units/25 µl)	Summer	25	0.80 ± 0.09 ^b
	Rainy	34	0.56 ± 0.04 ^a
	Winter	29	0.66 ± 0.02 ^{ab}
NBT _{540nm}	Summer	30	0.35 ± 0.01 ^c
	Rainy	12	0.25 ± 0.01 ^b
	Winter	11	0.03 ± 0.002 ^a
Glucose (mg/dl)	Summer	27	92.34 ± 4.98 ^b
	Rainy	12	51.53 ± 5.09 ^a
	Winter	11	47.79 ± 7.61 ^a
PCV (%)	Summer	24	33.75 ± 1.12 ^b
	Rainy	12	23.25 ± 2.33 ^a
	Winter	10	23.1 ± 1.21 ^a
Hb (G%)	Summer	24	8.71 ± 0.38 ^b
	Rainy	12	7.57 ± 0.54 ^b
	Winter	10	2.74 ± 0.21 ^a
TEC (10 ⁶ cells/cu. mm of blood)	Summer	15	1.97 ± 0.26 ^b
	Rainy	6	1.16 ± 0.10 ^a
	Winter	10	1.25 ± 0.14 ^{ab}
TLC (10 ³ cells/cu. mm. of blood)	Summer	12	45.1 ± 4.12 ^b
	Rainy	6	29.51 ± 3.94 ^a
	Winter	7	23.18 ± 1.57 ^a



Project Title : A comprehensive study on Argulosis: Host-parasite interaction with respect to modulation of innate and specific immune responses, and development of preventive or control measures

Project Code : NFBSRA-AP20

Duration : December, 2007-January, 2012

Funding Agency : National Fund for Basic & Strategic Research in Agricultural Sciences

Project Personnel : P. K. Sahoo (PI), J. Mohanty, J.K. Jena and Hema Prasanth

Three major farms from Andhra Pradesh and three farms of West Bengal as well as few berries of West Bengal were surveyed during this period. Samples of Argulus were collected for further study. Blood collected from various grades of argulus-infested rohu were utilized to measure the innate immune status of fish. Results showed that blood glucose level, total serum antiprotease, total serum protein were significantly ($P < 0.05$) higher in different degrees lice-infested fish compared to uninfested control whereas complement activity, γ macroglobulin activity were significantly ($P < 0.05$) lower in lice-infested fish compared to uninfested control. The NBT assay and serum myeloperoxidase, lysozyme and ceruloplasmin activities, serum haemagglutination and haemolysin titres as well as packed cell volume were not affected among uninfested control and lice-infested fish irrespective of degrees of infestation. However, a higher value of blood glucose level, NBT activity, total antiprotease level was marked in lice-infested female fish compared to their respective control. The present study also showed a significant positive correlation of blood glucose level, total antiprotease, NBT and

myeloperoxidase activities with degree of lice-infestation. This study indicated that fish immune system particularly of female fish is significantly influenced by Argulus infestation.

E. Social Sciences

Project Title : Biotechnology Information System Network (BTISnet)

Project Code : E-01

Duration : 1991-92 continuing till date

Funding Agency : DBT funded

Project Personnel : A. K. Roy, G. S. Saha, N. Panda and D. P. Rath

Infrastructure Development

The Central Institute of Freshwater Aquaculture (ICAR), Kausalyaganga, Bhubaneswar established during 1990-91 is a Distributed Information Sub-Centre (Sub-DIC) under Biotechnology Information System (BTIS) Network of the Department of Biotechnology, Ministry of Science & Technology, Government of India. The centre is specialized in the field of research and development of Aquaculture in respect of management information system, human resource and informatics based infrastructure. The center is well equipped with latest model computers (P-IV), scanner & laser printers, LCD projectors, database, CD Mirror Server, ASFA on-line database, software packages and communication facilities viz., BSNL leaseline (256 kbps) and VSAT (512 kbps). Since inception, the BTIS center has conducted many 'National Workshops-cum-Trainings on Bio-informatics and Statistics in Aquaculture Research' and about 600 number of state officials & researchers have been apprised about the latest technologies in ICT, statistics & economics application on aquaculture research. The center has also developed human resource through offering traineeship and studentship under DBT Programme.

Correspondance Analysis (CoA) of genomic sequence of carps using Statistical Package for Social Sciences (SPSS)

Correspondance analysis on 38 nucleotide sequences including EST (24 expressed sequence tags) and CDs (14 Coding Sequences) of Labeo rohita was carried out and it was found that most of the sequences were baised to GC ending codons.

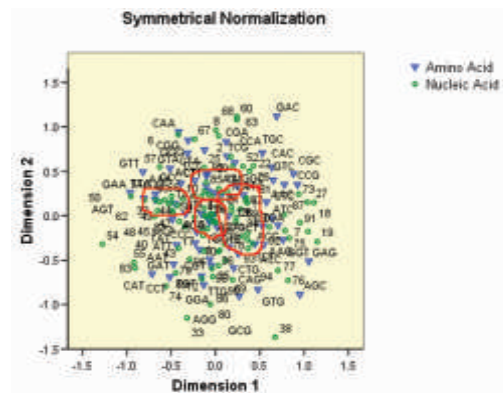


Fig. 48. Symmetrical normalization

Biplot showing association between genes and codons of L. rohita

Correspondence analysis of RSCU (Relative Synonymous Codon Usage) of 13 genes of Cyprinus carpio was carried out. From the biplot generated by SPSS it was revealed that the genomic sequence of Cyprinus carpio is rich in GC content.

Stepwise demonstration of the correspondence analysis using SPSS was carried out to understand the intermediate steps of analysis. The correspondence map of symmetric normalization revealing the association between nucleotide sequences and codons were plotted through a number of steps which includes generation of profiles and distances, active margins, masses, singular values, inertia and finally the scores in various dimensions that are the coordinates for points in the plot.

Forecasting of fish production by culture environment, group and species level

For perspective planning of fisheries development policy, forecasting of fish production is needed. The Bioinformatics Centre attempted to forecast

fish production at species and group level for both capture and culture fisheries based on time series data of FishSTAT Plus and inbuilt software. Inter and intra-species contribution of various species to total fish production has also been worked out. The projected figure for 2020 is estimated to be 8.79 mmt which compares favourably with the projected production of 8.00 mmt in 2020 under most likely (baseline) estimate by IFPRI. In 2020 fish production from capture fisheries will decline to the extent of 31% from 3.63 mmt recorded in 2004. But aquaculture production will demonstrate a 2.36 times increase in 2020 from to the production of 2.47 mmt recorded in 2004. In aquaculture sector contribution of exotic species will be more compared to Indian Major Carps (IMC) in 2020. In capture fisheries, pelagic marine fish will contribute slightly higher but crustaceans and molluscs substantially in 2020, whereas contribution of diadromous fishes, demersal marine fish will decline. Ratio of capture to culture will decline considerably in 2020. Consequences of decline in capture fisheries on socio-economic parameters have also been studied.

Project Title : Impact Assessment of Fisheries Research in India
Project Code : E-38
Duration : April 2006-October 2008
Funding Agency : ICAR AP Cess Fund Scheme
Project Personnel : H. K. De (PI) and G. S. Saha and N. Panda

Impact assessment study has been undertaken among the in service trainees who attended training programme at CIFA during the last three years. The objectives were to study the extent of effectiveness of training programmes on freshwater aquaculture; to ascertain the level of satisfaction of the trainees and to identify the reasons for not utilizing newly acquired knowledge and skills in present work situation. Out of 300 mailed questionnaires send to the trainees and students a total of 127 completed scheduled returned. Data has been tabulated and preliminary analysis reveals the following:



- 68% of the respondents were sponsored candidates and 32% used their own resources to attain training at CIFA.
- As many as 97% respondents indicated that practical sessions were useful.
- 56% of the respondents used the reading material at least once a week, 24% used at least once a month and the rest used the same rarely.
- About different parameters of the training i.e. content, relevance of topics, practical sessions and competency of the resource persons the mean score obtained was 4.39, 4.52, 4.37 and 4.46, respectively. This indicates very high level of satisfaction with the training provided by CIFA.

Lack of infrastructure, administrative support, motivation and fund are indicated as some of the constraints that prevent utilization of new skills and knowledge in their work place.

F. Application of Plastics 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), N. K. Maiti, S. P. Mohanty, K. K. Sharma, B. Sarkar and D. Majhi

Adoption of plastic-lined ponds for water temperature enhancement and seepage control in polyhouse/open aquatic environments

Two numbers of even span green houses each having length of 11 m and width 7.8 m were

constructed over earthen ponds of size 9.0 × 6.0 m for experimental purpose. The experiment with three treatments viz., (i) green house with LDPE pond lining, (ii) green house without pond lining, and (iii) open pond without pond lining was conducted for data validation during winter period from December, 2007 to March 2008 with Labeo rohita as culture species. Water, ambient air and green house room air temperatures were measured by calibrated mercury-filled glass bulb thermometer having least count of 0.25°C. A digital hygro-thermometer (model: Lutron HT-3003) was used to measure relative humidity in the green house. Wind velocity was measured with digital portable anemometer. Physio-chemical parameters were monitored at 8:00 and 16:00 hours of a day every week for dissolved oxygen, pH, free CO₂, total alkalinity, ammonia-N and nitrate-N. The water quality parameters of both the experimental ponds were within optimum ranges throughout the experimentation period and found suitable for aquaculture. The water temperature showed marked variations between both the treatments due to green house effect. The other parameters did not show any significant variations between the treatments. The results indicated that fish growth inside green house was better in terms of weight-gain and survival due to prevailing higher water temperature. Plankton production was higher in the polyhouse ponds water because of temperature effect. A 4.50 - 6.75 C higher water temperature was recorded in polyhouse plastic-lined pond in comparison to that in open fish pond.

Development of demand fish feeders

Three numbers of FRP demand fish feeders of 30 l capacity were installed in three cement cisterns each of 10 m³ capacity to evaluate their efficiency

in field condition. The experiment was conducted in running water system with *Labeo rohita* as experimental species. The FCR value did not vary significantly. The experiment revealed that the feeders have to be evaluated in pond culture system keeping the traditional system as control.

Development of FRP silos/vertical-tire system for super intensive rearing of fish

FRP silo fish holding system with 3, 6 and 9 m³ volumes water holding capacity and 0.8, 1.6 and 2.4 m water depths, respectively was designed and fabricated at the center as a hi-tech system. Biomass holding (per unit area) experiments was conducted in the silos with *Labeo rohita* as test species. The experiment was conducted in winter season of 2007-08 with stocking density of 3 kg/m³. The results revealed that fish survival were higher in silos having water depth 0.9 m followed by 1.8 m and 2.7 m. The silos with water depth 2.7 m produced higher mortality due to lower DO concentration. The average fish survival levels were 94 and 88% in silos having water depth 0.9 m and 1.8 m, whereas, silos having 2.7 m water depth produced mortality of 68%. This may be attributed to lower surface area of the silo in comparison to its volume, which lowered DO content in water column. The silo may be used for holding fish biomass for a short duration with provision of oxygen supply to the system.

Field Level Demonstration of low cost FRP hatchery for carp seed production

The product was installed in different parts of the country during 2007-08 as mentioned below:

- National Bureau of Fish Genetic Resources, Lucknow, Uttar Pradesh in 2006 and 2007.
- Sardar Vallabh Bhai Patel University of Agriculture and Technology, Modipuram, Meerut, Uttar Pradesh in 2007.
- West Bengal Citizens Forum, East Basanti Island, Sunderbans Delta, 24 Parganas (South), West Bengal in 2007.
- West Utkal Agricultural Center, Diptipur, Bargarh District, Orissa in collaboration

with NR International, United Kingdom in 2007.

- Two sets in State Fisheries Department, Nihoto and Kohima, Nagaland in 2007.
- State Fisheries Department, Itanagar, Arunachal Pradesh in 2007.
- Two sets in State Fisheries Department, William Nagar and Shilong, Meghalaya in 2007.
- Banaras Hindu University, Varanasi, Uttar Pradesh in 2006 and 2007.

G. Field Station, Kalyani

Project Title : Large-scale seed production of Ompok and *Mystus* spp. and study of growth performance of Ompok pabda and *Mystus vittatus* using different diet under variable physico-chemical condition

Project Code : I-48

Duration : April 2005-March 2008 (extended till March, 2009)

Funding Agency : Institute-based

Project Personnel : N. M. Chakrabarty, P. P. Chakraborty and S. C. Mandal

Collection of brood fishes of Ompok pabda, gonadal maturity study and breeding

Trials were conducted to rear and produce brood fishes of pabda in indoor rearing facilities and in glass aquarium under controlled conditions. Water parameters were monitored. Brood fishes were fed with ground silk worm pupae, live tubifex worm and boiled chopped chicken viscera regularly along with their natural food. The fishes which attained av. size of 16-18 cm / 25-27 g were found to be matured and were selected for induced breeding.



Processed silkworm pupae used as protein source of pabda

Breeding of aquarium reared pabda

Fry of pabda were successfully reared in aquaria under controlled conditions and fed with tubificid worm, processed chicken viscera, silk worm pupae, isolated soy protein and plankton. The fishes attained maturity within 10-11 months and were induced to breed.

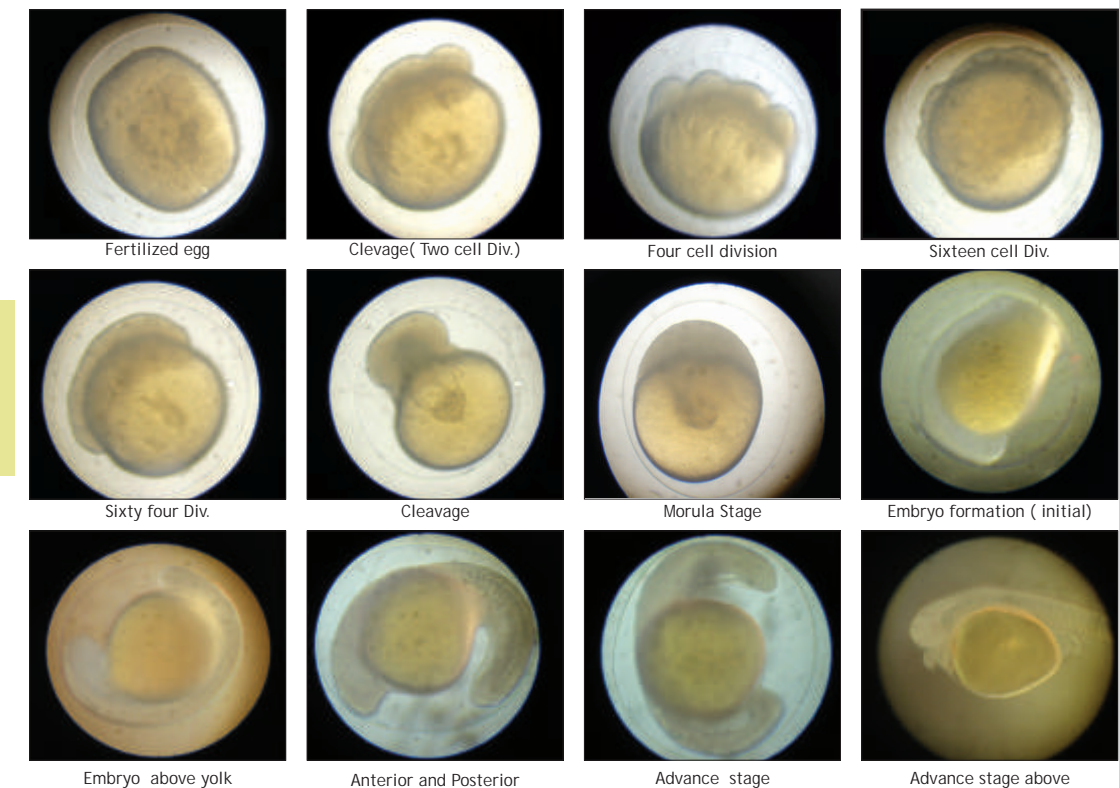
Embryonic development of Ompok pabda

About 30 min after fertilization, a blastodisc was found to form over the yolk mass following first, second and third cleavage. Sixty-four cell stage was observed after 70 min of fertilization followed by morula stage in two hours. Yolk plug stage appeared on the 5th hour. Between 10-15 hour post-fertilization, cephalic and caudal end of the embryo differentiated. In 16-21 hour the gut was faintly noticed posterior to the yolk sac leading to anus, embryo looked active within egg shell. On the 22nd hour thrashing movement of embryo was observed. Hatchling came out after 23 hour of fertilization.

Table 30. Physico-chemical attributes recorded during breeding of Pabda

During injection	Water temp (°C)	Dissolved oxygen (mg/l)	CO ₂ (mg/l)	pH	Alkalinity (mg/l)	Hardness (mg/l)
Farm ponds	26-28	6.7	8	7.6	120-152	116-156
Aquarium (during breeding)	26	7.5	6	7.4	136-148	128-136
Aquarium (after hatching)	28	7.4	8	7.5	132-142	128-136

Different Stages of embryonic development of *O. pabda*





Hatching of pabda

The hatchling of Ompak pabda obtained from induced breeding experiment were reared in cement/fibre glass tanks (4ft.x2ft.x2ft.)/400 l capacity each) with proper aeration facility. From the second day onwards, hatchlings were fed with well-sieved daphnia-rich 200 plankton collected from the farm pond, artemia naupli (cultured in laboratory at 10 ppt. salinity) and chopped tubificid worm daily. Spawn (3-4 mm/20 mg) attained size 30-35 mm/207-245 mg within a fortnight with 61% survival.

Rearing and growth study of spawn to fry of pabda



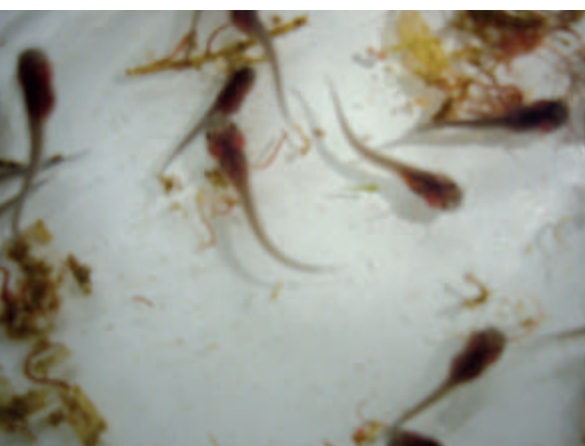
Rearing of spawn in hapa

The rearing of pabda in experimental yard was carried out and well-sieved daphnia-rich zooplankton, chopped tubifex worm and silk worm powder were produced as feed regularly. The size range of 7.0 cm/2.5 g - 9.5 cm/4.2 g with an average size of 8.5 cm/3.8 g was recorded from an initial size of 3-4 mm/2.0 mg in a rearing period of 100 days.

Grow out culture of pabda in earthen pond

Three thousand fry of O. pabda with an average size of 8.5 cm/ 2.76 g were stocked in an earthen pond of 0.1 ha at stocking density 30,000 fry/ha. The stocked population were fed daily with a mixture of ground nut oil cake and silk worm pupae (1:1) at 5% of body mass in dough form.

Marginal and floating weeds were allowed to grow in the pond, which provided shelter to growing pabda. Manuring with cowdung favoured



Rearing of spawn in tank



Pabda fingerlings ready for stocking in culture pond

zooplankton growth, the preferred feed for the species. Proper nutrient management was adhered. However, survival was low due probably to rise in water temperature during summer. In the grow out culture system, pabda attained an average size of 16.70 cm/24.0 g in a culture period of 120 days. A total of 8.64 kg pabda were harvested and the survival rate was 12.0%.

Studies on food and feeding habit of *Ompak pabda*

Ompak pabda in the fry stage (up to about 25 mm in length) was observed to feed almost exclusively on zooplankton consisting of cladocerans, copepods, rotifers and protozoans and soft insect larvae and showed high cannibalistic tendency (2nd day onwards).

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Fig. 49. Growth of pabda in culture

The length range between 26-40 mm were found to feed predominantly on zooplankton and small aquatic insects' larvae. In fry and juvenile stages, cannibalistic tendency was rare. Fishes above 70 mm in length were found to feed on insect larvae and small insects, fry and small minnows, shrimps, nematode worms, annelids, parts of aquatic plants and detritus.



Netting of pabda stock for screening at matured brooders

Breeding and seed rearing of *Mystus vittatus*

A total of 850 nos of brood fishes (size range 9.6-13.9 cm/18.0-25.2 g) were maintained in a 0.4 ha pond; the fishes were regularly fed with boiled chicken viscera and observed for their maturity. During August - September 2007, 20 sets of breeding experiments were carried out using male weighing 15-20 g and females weighing 30-40 g. Ovaprim at doses 1.0-1.5 ml/kg body mass for female and 1.0 ml/kg body mass for male was administered. Injected brooders were released both in 400 l capacity fiberglass tank containing rain water up to a depth of 8 inches with submerge aquatic weed as well as in hapa fitted in pond. Spawning took place between 7 and 10 hour post-injection and



Ripe female



Hormone administration

hatching occurred between 21 and 24 hour after fertilization. The rate of spawning of females, fertilization of eggs and hatching were 70, 80 and 60% respectively. A total of 0.70 lakh of hatchlings obtained were released in fibre glass tank for further rearing.

Studies on food and feeding habit of *Mystus vittatus*

The gut contents of 100 post larvae, 150 juveniles and 220 adult were specimens examined for quantitative and qualitative assessment of food and feeding of *M vittatus* in different life stages. The post larvae (5-25 mm) were observed to feed on zooplankton consisting of mainly cladocerans (*Moina*, *Ceriodaphnia*, *Bosmina*, *Simocephalus*, *Alonella*), rotifers (*Brachionus*, *Keratella*, *Asplanchna*, *Monostyla*) and copepods (*Cyclops*, *Diaptomus*, and their naupli) and protozoans (*Ciliates*, *Diffugia*, *Arcella*) (Fig. 50a). A small quantity of *Microcystis*, *Volvox* and other colonial algae were observed to pass through the gut mostly in undigested condition, suggesting that they are not preferred food of the species. Most of the juveniles (26-45 mm) consumed zooplankton (mainly copepods), followed by aquatic insects and their larvae (small hemipterans, coleopterans and notonectids). Phytoplankton, mud, detritus and vegetable matter (filamentous algae and part of small aquatic plants) were also found in the natural diet (Fig. 50b). The food of adults (46-118 mm) constituted mainly of zooplankton and small aquatic insects in bulk, followed by less quantity of worms (annelids and nematodes), mud, detritus and vegetable matter (Fig. 50c). Most of the adults had full stomachs. Empty stomachs with trace amount of food was rarely seen, suggesting high intensity of feeding of the species.

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Fig. 50. Percentage composition of food items in different size groups of *M. vittatus*

The study on *M. vittatus* revealed an exclusively phytophagous food habit in post-larval stage and change over to an essentially plankton and insect predominated diet in juvenile stage. The adults mainly feed on plankton and aquatic insects; worm, mud, detritus, vegetable matter in small quantities constitute as supplementary natural feed. The fish seems to explore all ecological niches for food.

Photo required

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Project Title : Study of fish biodiversity, breeding and culture of carps and some selected ornamental fishes in North-eastern state of Meghalaya

Project Code : I-45

Duration : April 2004-March 2008

Funding Agency : Institute-based

Project Personnel : N. M. Chakraborty, (PI), P. Chakrabarti, S. K. Swain, S. C. Mondal and R. N. Saha

first month and rest in equal monthly installment), SSP @ 400 kg/ha/yr (equal installment once in a fortnight), Urea @ 250 kg/ha/yr (equal monthly installment) and particularly lime @ 1,000 kg/ha/yr (1/3rd in first month 21 days before fish stocking and rest in equal monthly installment). Bottom raking was done at fortnightly interval.

Aquaculture development in Garo hills (Meghalaya) is considered as a thrust area. Broodstocks of IMC were maintained in Digrichiring fish farm, Tura West Garo Hills, Meghalaya and with a progressive fish farmer at Williamnagar. Breeding of IMC was successfully done in Digrichiring fish farm with active collaboration of State Fishery staff. For mass scale production of carp seeds, a portable FRP hatchery was installed at Williamnagar. Few interested carp breeders were identified and trained. Water quality was maintained a optimum condition for brood stock rearing for breeding through management as RCD @ 10,000 kg/ha/yr (20% in



Electric Eel in Rongram river, Meghalaya

Fish diversity in Simseng and Rongram river stretches through East, West Garo hills covering Tura, Williamnagar and some portions of Aghmara, Meghalaya was surveyed. Several fishes of ornamental value with export potential were identified.



Gara species in Simseng river, Meghalaya



Chocolate Mahasheer in Garo hills

H. Regional Research Centre, Rahara

Project Title : Aquaculture diversification and wastewater management
Project Code : I-60
Duration : April 2007 - March 2010
Funding Agency : Institute-based
Project Personnel : A. K. Datta (PI), S. P. Rai, B. N. Paul, S. K. Manna and B. K. Pandey

Sub-project (A): Seed production of *Etropolis suratensis* - its biology and seed rearing

Breeding
 Pond-grown adult *E. suratensis* fish (90-210 g) were kept in FRP tanks for maturation and breeding. Though matured, they failed to spawn in tanks.

However, successful breeding of the fish was noticed in pond condition when four pairs of gravid male (90-180 g) and female (110-240 g) were kept in a prepared pond with aquatic weeds, hide outs like earthen hundies and other substrates. Parental care was observed even after free swimming stage when the offspring became 6-7 days old. The small fish were found to move in a shoal for about more than a month. About 2000 fry and early fingerlings of *E. suratensis* were obtained.

Breeding behaviour and biology

Observations reveal that during spawning period the species formed monogamous pair bonds with nuclear family. Breeding activity was also observed on open surface water. A fully matured fish (100-230 g) bears different sizes of eggs measuring 1.0-2.27 mm in diameter of which more than 75% are bigger size. Results on the gut analysis indicated the herbivoretic feeding habit of the species.

Monoculture

Seed of *E. suratensis* (0.8604.0 g) were stocked @ 2550 nos/ha in earthen ponds. The fish registered about 8 fold increase in body weight. Survivability was poor.

Mixed culture with carps

Seeds of *E. suratensis*, raised in the spawning pond (0.08 ha) were collected and stocked in pond at 2500 nos/ha. Two different size groups, small (1.17 g) and large (36.0 g) were stocked. Major carps were also stocked in the same pond at 3000/ha with the species composition of catla (40%), rohu (30%), mrigal (15%), bata (15%). During harvest after one year, the smaller group did not represent in harvest. The higher size groups attained an average size of 186.31 mm/88.28 g. Absolute growth gain of *E. suratensis* within the culture period was recorded as 52.28 g, growth increment/day being 0.115 g.



Seeds of etroplus produced at centre



Catch of etroplus in mixed culture with carps

Within a culture period of 10 months in IMCs registered 8-9 fold increase in body weight. *E. suratensis* contributed to 4% of total production (1131 kg). Small sized *E. suratensis* were not represented viz., the catch, which might have moved away from rest of the shoal. Overall survival rate of *E. suratensis* was 21% but that of higher size alone was 37%.

Rearing of pabda

Fifteen days old pabda seeds were brought and acclimatized in 11 FRP tanks for 16 days. The fish attained an average size of 46.8 mm/0.58 g from initial size of 22.9 mm/0.107 g. After acclimatization fish were distributed uniformly (45 nos/m²) in 8 FRP tanks, each having area of 0.6 m². Initially, the seeds were fed with live zooplankton and whole tubifex worm for one month and later on fed with formulated feed when it was noticed to accept well. In 146 days the fish attained about 3 fold increase in body weight with a survival of 74% culture of 7 days old pabda for 14 days in FRP tanks yielded almost 12 fold increase in body weight with 55% survival. The pattern of growth of the fish with this stocking density indicates the point of inflexion i.e. beyond this period there is no point of keeping fish with same density (Fig. 51).



Fig. 51. Absolute growth increment during culture period showing point of inflexion

After one month, second phase of rearing was conducted with the same seed in a FRP tank at a density of 31 nos/m² (3.1 lakhs/ha) and continued for 128 days. Within this period the fishes exhibited on average size of 77.33 mm/2.45 g from 51.6 mm/0.805 g with growth increment being 0.13 g/day and 81.82% survival.

Culture of 15 days old pabda for 17 days in FRP tanks yielded about 5 fold increase in body weight with 100% survival.

Second phase of rearing was initiated with the harvested fish at a lower density of 10.8 nos/m² (1.08 lakh/ha) in a FRP tank of 3.7 m² area which was further lowered down to 4.05 nos/m² (40.5 thousand/ha) within 121 days due to daily mortality of one or two fishes and after that no mortality was observed up to the end of culture period i.e. 198 days. A fluctuated growth increment was noticed up to 121 days and afterwards steady growth was observed. Initially such fluctuating phenomena was perhaps due to overstocking. Obviously, growth rate at later stage is higher comparatively than that of initial stage due to the possible reasons of higher density at initial stock. Higher growth rate toward the fag end of rearing period could be attributed to low water temperature and stocking density. Growth rate of the reared fish for total culture period is represented in Fig. 52.



Fig. 52. Month-wise average weight of *O. pabda* with effect of density & temperature



Pabda haul in farm pond

In 198 days the fish registered about 19% increase in body weight. Produced pabda seeds were stocked in a small (0.02 ha) grow out pond at 5,000 nos/ha. In 2½ months pabda achieved about 4 fold increase in body weight.

Fry and fingerlings of pabda exhibited allometric growth (Fig. 53).

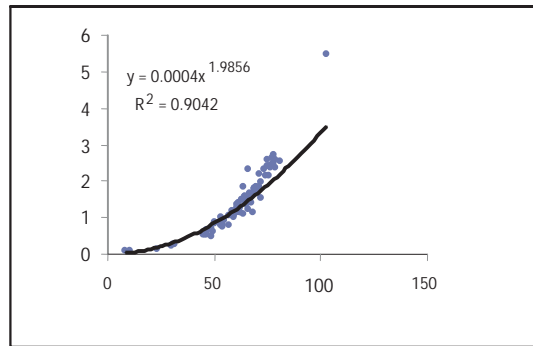


Fig. 53. Length-weight relationship of *O. pabda* fry and fingerling

Biological study of *Nandus nandus*

Preliminary studies reveal that *N. nandus* (90-100 g) attain maturity in the month of April. The fish is carnivorous having shorter gut, the ratio between body and gut length being 1:1.64. The left ovary was found to be much broader and longer compared to right one, length of ovary being 61 cm. The weight ratio between body and ovary (ovary: body weight) and the GSI have been recorded as 1:8.2 and 12.22% respectively.

Table 31. Metals concentration in different fish species

Species	As (ppb)	Cd (ppb)	Cu (ppm)	Mn (ppm)	Zn (ppm)	Fe (ppm)
<i>L. bata</i>	0.737	1.096	0.015	0.0438	0.646	0.49
<i>C. mrigala</i>	0.1972	0.8163	0.0157	0.12	0.289	0.598
<i>L. rohita</i>	0.183	0.562	0.02	0.082	0.508	0.356
<i>H. molitrix</i>	0.844	0.757	0.043	0.103	0.297	0.014
<i>Catla catla</i>	0.89642	0.80798	0.05835	0.10981	0.202227	0.73839

Table 32. Metal concentration in different samples

Samples	As (ppb)	Cu (ppm)	Mn (ppm)	Zn (ppm)	Fe (ppm)
Sewage	1.015	0.0349	0.4525	0.08	0.119
Plankton	ND*	0.02	0.855	0.06	8.2
Lamellidens	ND*	0.02	13.3498	1.59	6.1
Gastropod	ND*	0.2	0.5248	1.7	2.7
Sludge	ND*	0.53	10.28	14.59	49.66

* Not done

Fish culture with community wastes

Work was initiated in a pond (0.08 ha) at Samaj Sevak Sikshan Mandir, R. K. Mission, Belur Math involving rural boys of many districts of West Bengal. The pond was stocked with major and medium carp at 5,000 fingerlings/ha. Culture was continued for 11 months and about 3 t/ha production was achieved. Major carps and bata registered about 14 and 5 fold increase in body weight.

Sub-project B : Study of heavy metals in wastewater, soil and fish

Samples of wastewater, sludge, soil, plankton, gastropod, pearl mussel *L. marginalis* and fish were been collected and processed manually for estimation of heavy metals by Atomic Absorption Spectrophotometer and 10 samples of each have been analysed for different metals. Results are given in Table 31 & 32. The average weight of different fish species were bata 90 g, silver carp 83.0 g, rohu 50.5 g and mrigal 27.0 g. A comparative study on accumulation of heavy metals in flesh and gills of silver carp, rohu and catla showed comparatively high accumulation of heavy metals in fish gills than in the fish tissue (Table 33).

Table 33. Comparative study of accumulation of different heavy metals in fish flesh and gills

Sample		Cu (ppm)	Mn (ppm)	Zn (ppm)	Fe (ppm)
Silver carp	Flesh	0.043	0.103	0.297	1.014
	Gills	0.078	0.744	1.121	6.983
Rohu	Flesh	0.02	0.082	0.508	0.356
	Gills	0.04	0.848	2.437	10.32
Catla	Flesh	0.058	0.109	0.202	0.738
	Gills	0.067	0.714	2.092	6.89

Rearing of scampi in treated dairy effluent

A pond of 120 m² at Metro Dairy Limited, Nilgunj, Kolkata was prepared, limed and stocked with juveniles of scampi in mid October, 2007 at 2,100 nos./ha. Growth performance of scampi was 25.0 g from initial weight of 13 g in 75 days.

Sub project C : Nutrient flow in integrated pond aquaculture system using duck

Carp-cum-duck culture was initiated. Carps @ 5000 nos/ha (catla 25%, silver carp 15%, rohu 30%, mrigal 20% and bata 10%) and ducks @ 200 nos/ha were included in an integrated system. Hydrological parameters, microbiological features and zooplankton volume were studied.

It has been observed that each adult duck voids about 120-150 g faecal matter per day. However, preliminary observation indicates that duck faecal matter contains crude protein-12.98%; lipid (Ether extract) 1% and total N- 2.07%.

In 15 days silver carp, catla and 'Jayanti' rohu attained 1, 1.6 and 2.0 fold increase in body weight, respectively. During the period maximum growth increment/day has been registered for Jayanti rohu (3rd generation) and catla, being 4.2 g and 4.1 g/day respectively.

I. Regional Research Centre, Bangalore

Project Title : Propagation of selected peninsular/indigenous fishes for incorporation in to aquaculture and modification of aquaculture practices for water deficient regions

Project Code : I-62

Duration : April 2007 - March 2010

Funding Agency : Institute-based

Project Personnel : M. R. Raghunath (PI), N. Sridhar and Hemaprasanth

Monitoring oogenesis/spermatogenesis in *P. pulchellus* in response to administration of individual hormone preparations

Signs of sexual maturity were first observed in *Puntius pulchellus* males in July 2007. Oozing of milt was observed by September accompanied by clear expression of secondary sexual characteristics. The females did not however, show clear indications of breeding readiness. Priming of females with 17- Estradiol hormone was started in August and four weekly doses were administered orally in the form of pellets at 8 mg/kg b.w. As this did not bring the females to readiness, two injections of HCG at 200 I.U./ fish were given once a week for 2 weeks followed by a dose of 500 I.U./fish/week during 3rd and 4th weeks of September to the same females. Breeding attempts using Ovaprim or Ovatide at graded levels on repeated occasions failed to release eggs from females although oozing of milt did occurred from males.

Other observations

Incidence of whitish hard protuberances were observed on fin rays of some pulchellus, which resulted in sharp break of the fins at that point. Administration of Furazolidone at 11 g/kg of feed for 3 weeks resulted in disappearance of the symptoms. No mortality was noticed on account of this deformation.

Field collection of peninsular carps and their adaptation to captivity

An exploratory survey was made in the Hogenkal and Mettur area of Tamilandu to ascertain the availability of some minor carps with culture potential. The area surrounding Hogenkal was found to be a rich fish biodiversity spot with good catches of *P. carnaticus*, black spot barb and tentatively identified specimens of *Cirrihinus reba* and *Nukta nukta*.

Juvenile *P. pulchellus* (130 nos) were collected from the Gajanur dam downstream area and brought to CIFA farm during January 2008. Although some mortalities were observed during transportation, about 100 nos. survived and are presently under acclimatization in the farm.

Collection of fish entrails from market and standardization of procedures for preparing coenzyme extracts

Rohu (3 nos) with a total weight of 4.5 kg yielded about 0.090 kg of entrails from which an aqueous extract (containing 2.68 g of protein) was obtained. Activities of amylase, trypsin, chymotrypsin and total protease were assayed in the extract, which showed good activity of amylase (698 μ moles Glu/mg protein/h) but had poor total protease activity (15 μ moles Tyr/mg protein/h) which was reflected in poor activities of trypsin (3.88 μ moles Tyr/mg protein/h) and chymotrypsin (0.66 μ moles Tyr/mg protein/h).

Setting up and monitoring closed carp culture system for water requirement and quality parameters

Three batches of common carp were bred in the FRP hatchery with a modified re-circulatory system. The modified system consumes only 23% of water consumed by normal mode of hatchery operation resulting in savings of over 77% in water requirements. The hatching rate was not affected by the recirculation process.

Infestation *Hydrilla* sp. in fish ponds was found to be easily controlled with a simple device made from a 2 mm wire rod based grill having 25 mm spacing. In comparison with manual de-weeding

of a 25 x 10 m² pond, which took 3-4 h by 2 persons, use of the fabricated device reduced the labour requirements to 2 h involving one person. The device was however, not very effective in removal of *Valisneria* sp. weeds whose infestation was also observed in the ponds.

Project Title : Kinetics of macromolecular cleavage in relation to nutrient availability in the peninsular carp *Labeo fimbriatus*

Project Code : E-30

Duration : May 2004 - August 2007

Funding Agency : ICAR AP Cess Fund Scheme

Project Personnel : N. Sridhar (PI) and M. R. Raghunath

Rate of hydrolysis of carbohydrate sources viz., ragi, ricebran and maize and protein sources viz., groundnut oil cake (GNC), silkworm pupae, soya bean meal and fish meal were estimated by partially purified enzymes obtained from rohu and *L. fimbriatus*. Low FCR and high weight gain were observed to take place when amylase to protease activity ratio approached the value of 1 (one) and trypsin to chymotrypsin ratio was highest in rohu. The feed ingredients GNC, silkworm pupae, soya bean meal and fish meal were hydrolyzed using partially purified digestive enzyme extracts of *fimbriatus* and rohu. The amino acid composition of these ingredients as well as that of the undigested residues from enzyme hydrolysis was evaluated to determine the release of individual amino acids from the feed ingredients as well as their availability.

Project Title : Biochemical studies on *Lernaea* species affecting peninsular fishes with an aim on development of reliable prophylactic and control measures against the parasite

Project Code : E-31

Duration : February 2005 - January 2008

Funding Agency : ICAR AP Cess Fund Scheme

Project Personnel : Hemaprasanth (PI) and N. Sridhar

Evaluation of efficacy of Ivermectin and Doramectin (anti-parasite drugs) against adult *Lernaea* sp. parasite in vivo through intramuscular and oral routes in *Labeo fimbriatus*, *Catla catla* and *Puntius pulchellus* was completed. Doramectin at 1 mg/kg body weight incorporated in feed effectively cured adult *Lernaea* infection in fishes within 19 days as compared to the normal course of 47 days. Ivermectin applied at 500 μ g/kg body weight in feed was less effective. Intramuscular administration of Ivermectin and Doramectin at 200 μ g/kg body weight effectively removed adult *Lernaea* attached to *fimbriatus* fingerlings, with the latter drug being more effective. Infection with *Lernaea* was recorded in the peninsular carp *Puntius pulchellus* for the first time and was successfully treated with doramectin.

J. Regional Research Centre, Vijayawada

Project Title : Improving production efficiency in aquaculture through integrated nutrient management

Project Code : I-56

Project Duration : May 2007 - March 2010

Funding Agency : Institute-based

Project Personnel : P. V. Rangacharyulu (PI), B. B. Sahu and B. S. Giri

Recycling of organic wastes

Organic wastes collected from different origin were processed to increase the rate of mineralization. Farmyard manure was subjected to anaerobic digestion for the production of methane and the resultant slurry was used for manuring ponds. Processed manures were found to be having equal nutrient levels to those of source materials. Utility of application of processed manures such as biogas slurry and vermin compost was experimented in fish ponds.

Experiment with biogas slurry

Biogas slurry was used at levels of 30 t/ha/yr. Slurry manure 15 t/ha was applied as basal dose during pond preparation. Jayanti rohu seed was stocked at the rate of 4,000 yearlings/ha. Plankton production, water quality parameters and nutrient status were studied at an interval of 10 days. Remaining dose of biogas slurry was used during the culture period at regular intervals. Within a culture period of 150 days 'Jayanti' rohu yearlings showed 7 fold increase in body weight.

Experiment with vermin compost

Experiments were also conducted using vermin-compost in fish ponds using Jayanti rohu under similar experimental conditions that have been followed for biogas slurry. Vermi-compost was applied in fish ponds at the rate of 6 t/ha. However, during pond preparation basal fertilizer regime included use of farmyard manure at application rates of 2 t/ha along with 2 t/ha vermin-compost. Subsequently, 4 t/ha vermin-compost was used in equal doses. Fish recorded an average weight of 715.80 \pm 19 g at the end of 160 days grow out culture period.

Table 34. Growth, FCR and SGR of anabas fed different carbohydrate sources

Diet	Initial weight (g)	Final weight (g)	Growth (g)	FCR	SGR
D1	10.30 \pm 0.18	23.20 \pm 0.30	12.90 \pm 0.15	3.54	0.90
D2	10.60 \pm 0.43	24.16 \pm 0.76	13.56 \pm 0.35	3.56	0.91
D3	10.45 \pm 0.46	25.07 \pm 0.87	14.62 \pm 0.43	3.49	0.97
D4	10.36 \pm 0.45	23.80 \pm 0.61	13.44 \pm 0.73	3.52	0.92



Application of bio-fertilizers

Fish hydrolysate

Fish hydrolysate was prepared using trash fish. The trash fishes were chopped into small pieces and subsequently jaggery, urea and lime were added in a plastic drum of 100 l capacity. The contents were stirred daily. The resultant liquid obtained after 21 days was used for pond application. Application of fish hydrolysate enhanced plankton production in experimental ponds compared to control ponds.

Feed development for Anabas

An experiment was conducted to study the effect of different carbohydrate sources on growth of climbing perch for a period of 100 days. Anabas (average initial body weight of 10.43 g) were fed with diets having different carbohydrate sources such as maize powder, jowar powder and rice powder. The feeds were provided to anabas at 5% of body weight in two equal installments. The source of carbohydrates did not show any significant effect on growth of the species.

Project Title : Utilization and recycling of palm oil mill effluent-Evaluation of PKC in fish feed (Collaborative Project with NRC Oil Palm, Pedavegi)

Project Duration : November, 2004 - Continuing

Funding Agency : ICAR AP Cess Fund Scheme

Project Personnel : M. Kochu Babu (NRC, Oil Palm) (PI), P. Kumaraiah and P. V. Rangacharyulu

Jayanti rohu fingerlings of average initial body weight of 10.5 g were maintained on diets having 0, 10, 20 and 30% palm kernel cake for 90 days in 1 m³ circular cages. Twenty number of fishes were stocked in each cage. Fishes were fed with these experimental diets at 5% of their body weight. Sampling was carried out fortnightly to record increase in fish body weight. Significantly higher growth of 110.15 ± 1.45 g was obtained in diet having 10% PKC and there was a decrease in growth compared to control above 10% level of incorporation. From the experiment it could be concluded that PKC can be incorporated at a maximum 10% level in the diets of Jayanti rohu for better growth.

Table 35. Growth of rohu fed with palm kernel cake for 90 days

Diet	Initial weight (g)	Final weight (g)	Growth	FCR	SGR
D1	10.50 ± 0.80	90.65 ± 1.10	80.15 ± 1.20	3.26	2.39
D2	10.60 ± 0.95	120.75 ± 1.60	110.15 ± 1.45	3.10	2.70
D3	10.50 ± 0.72	88.10 ± 1.25	77.50 ± 1.26	3.34	2.29
D4	10.60 ± 0.80	90.65 ± 1.35	79.40 ± 1.56	3.29	2.33

TECHNOLOGY TRANSFER AND TRAINING

Krishi Vigyan Kendra (KVK)

Vocational training and training to in-service personnel

The KVK organized a number of need-based

vocational training programmes for the farmers, rural youths and in-service personnel in different disciplines (Table 36) and carried out extension activities (Table 37).

Table 36. Vocational training for farmers and in-service personnel

Discipline	No. of participants					
	Vocational training	In-service training	FLD		OFT	Total
			Oil & pulses	Others		
Fisheries	95	-	-	61	02	158
Women in agriculture	290	40	-	25	9	364
Crop production	99	15	33	12	04	163
Plant protection	110	20	-	05	08	143
Horticulture	262	15	-	22	10	309
Animal Science	180	17	-	30	10	237
Total	1036	107	33	155	43	1374

Table 37. Extension activities

Nature of extension activity	No. of activities	No. of beneficiaries
Field Day	04	200
Exhibition	01	2300
Film show	14	300
Group meetings	03	71
Newspaper coverage	04	-
TV talks	02	-
Extension literature	02	-
Advisory services	19	289
Visit to farmers field for scientific advice	36	848
Farmers visit to KVK	23	306
Diagnostic visits	03	105
Exposure visits	03	79
Animal health camp	02	110
Total	116	1737

Training programmes funded by the National Fisheries Development Board

The Krishi Vigyan Kendra of the Institute conducted three training programmes on Fish culture - a suitable enterprise for promoting rural livelihood for the progressive farmers of Khurda District of Orissa (10-19 January, 21-30 January, and 12-21 February, 2008), sponsored by the National Fisheries Development Board. A total of 75 participants including 9 farm women attended the above training programmes.

Sixty trainees attended the training programme on 'Intensive Aquaculture in ponds and tanks' conducted at the Peninsular Aquaculture Division of CIFA at Bangalore. The National Fisheries Development Board financed the training and the trainees were selected from all over Karnataka on the basis of recommendations from the Karnataka

State Fisheries Department. The training in two batches of 30 trainees each were conducted during 25-29 February, 2008 and from 11-15 March, 2008.

Other training programmes

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 38.

Table 38. Training courses conducted during 2007-08

Sl. No.	Title	Duration	No. of participants
1.	Hands on training on Molecular biology techniques	19-28 June, 2007	10
2.	Short course on Application of cryopreservation techniques in aquaculture	9-18 July, 2007	19
3.	Breeding and culture medium peninsular carps (held at RRC, Bangalore)	23-28 July, 2007	01
4.	Induced breeding of carps and nursery management (held at RRC, Rahara)	23-28 July, 2007	37
5.	Genetic upgradation of Indian major carps	14-20 August, 2007	02
6.	International training programme on Carp breeding and seed production	20-29 August, 2007	20
7.	Carp breeding and culture	20-29 August, 2007	01
8.	Freshwater pearl farming	1-8 September, 2007	09
9.	Freshwater aquaculture	3-7 November, 2007	18
10.	ICAR sponsored short course on New initiatives in aquaculture extension	14-23 November, 2007	24
11.	Workshop on Application of molecular genetics in aquaculture and Inland Fisheries Management (sponsored by NACA & FAO)	27 November - 4 December, 2007	10
12.	Winter School on Recent advances in freshwater aquaculture nutrition	28 November - 18 December, 2007	25
13.	International training on Broodstock management, cryopreservation and selective breeding of carps (sponsored by ARDQIP, Ministry of Fisheries, Sri Lanka and World Fish Centre, Penang, Malaysia) (from Sri Lanka)	28 January - 9 February, 2008	02
14.	Hands on training on Molecular biology techniques	31 January - 8 February, 2008	10
15.	Ornamental fish culture for income generation	13-19 February, 2008	28
16.	Recent trends in freshwater aquaculture	20-26 February, 2008	19
17.	Freshwater pearl culture	21-29 February, 2008	11

18.	Freshwater aquaculture for rural livelihood for the farmers of Chattishgarh	3-7 March, 2008	37
19.	Recent trends in aquaculture and fisheries development	17-20 March, 2008	27
20.	National workshop-cum-training on Bioinformatics and statistics in aquaculture research	24-26 March, 2008	46
Total participants			356

Agricultural Technology Information Centre (ATIC)

During April, 2007-March, 2008, 2789 visitors comprising farmers, entrepreneurs, students, etc. visited the centre. This centre has generated revenue of Rs. 31,900/- from sale of priced publications. A large number of pamphlets/booklets were also distributed to the visitors.

HELPLINE services has been initiated wherein a group of experts attend to telephonic queries in fixed days of the week. Presently, the helpline work during 3.30 pm to 5.00 pm on every Tuesday and Friday. A total of 86 calls were received during the year.

North-east hill region

- FRP carp hatcheries were installed and demonstrated in ICAR Centre, Imphal, Ukhrool and Purul in Manipur, Dimapur in Nagaland, Shillong and William Nagar in Meghalaya, and Ita Nagar in Arunachal Pradesh.
- Breeding and seed production of magur, Indian major carps and common carp were successfully demonstrated in both hill and valley districts of Manipur.



Installation of FRP hatchery at Dimapur, Senli AO, Director, Dept. of Fishery, Nagaland



Simseng river potential source for indigenous small fishes of ornamental values

- Demonstrations of scientific carp culture using air blowers and formulated feed in Manipur.
- Demonstration on integrated fish-cum-pig farming in Govt. fish farm, Guwahati, Assam and on integrated fish culture in Manipur, Meghalaya and Nagaland were carried out.
- Demonstrated magur breeding and seed production in Barpeta and Mangaldoi in Assam.
- Training programme on recent advances in freshwater aquaculture was conducted in Shillong, Meghalaya for the field level officers.



Use of vermicompost in fish culture at Williamnagar, Meghalaya

- Demonstration on scientific carp culture with feed and fertilizer was conducted in Manipur.
- Organized Kisan Mela in Tupul, Manipur.
- CIFAX was dispatched to Manipur, Assam, Tripura, Nagaland, Meghalaya and Arunachal Pradesh for combating EUS.
- Participated in the Matsya Mahotsav in Guwahati, Assam.
- Participated in the Farmers field day organized by ICAR unit, Imphal.



Integrated pig-cum-fish demonstration in Nagaland

- Invited lecture was delivered at the National Seminar organized by St. Antony's College, Shillong.
- Demonstrated pig-cum-fish culture in six beneficiaries ponds of size ranging from 0.2-0.4 ha located at Dimapur District of Nagaland. Demonstration on carp culture programme with and without liming in six ponds of sizes ranging from 0.2-0.4 ha each was undertaken at Nagaland.
- Conducted an Awareness programme on "Ornamental fish breeding" at Nagaland for 5 fisheries officials of Nagaland Government. Visited Tura and William nagar to explore the possibility of establishing ornamental fish hatchery and meeting was held with the private farmer (Mr Sangma, National award winner) in presence of state fisheries officials. Visited West and South Garo hills, Simseng River, Meghalaya and collected few specimens of indigenous ornamental fish.
- Fifteen farmers of Assam and few officers visited ornamental fish breeding and culture unit at Kausalyaganga.



Activities at Suchiang's Ornamental Fish Production units at Killing, Meghalaya

- An ornamental fish hatchery unit was given to Nagaland state fisheries department, brood farm, Dimapur for up gradation of their existing production unit and another to Assam university, Ecology and Environmental Division, Assam for establishing a production unit.

Cage culture in Kunaria reservoir, Nayagarh

Six cages (each of 10 m² area) were installed in Kuanaria reservoir (FRL 200 ha) in Nayagarh district, Orissa and stocked with rohu (av. wt. 3.7 g) in July, 2007. They were fed with artificial feeds in submerged trays. Water and soil samples were collected and analyzed regularly. The fishes were sampled during end of September, 2007 and the average wt. was found to be 15.9 g.

Farmers' meet

An awareness camp on culture of improved rohu 'Jayanti' to upland farmers was conducted at KVK, Vinayashram, Kavuru, Guntur District on 30 April, 2007 by the Regional Research Centre of CIFA at Vijayawada.

The Institute organized a farmers meet at Kausalyaganga during 26-27 April, 2007 to create awareness and popularize the improved rohu 'Jayanti'. The programme was attended by nearly 143 farmers and farm women from Kendrapara, Balasore, Bhadrak, Khurda and Puri Districts. Scientist-farmer interaction session was also organized on the occasion where many production related queries were answered by the experts.

ToT-Capacity building of the primary stakeholders in sustainable management of aquaculture in Western Orissa

The workshop on ToT - Capacity building of the primary stakeholders in sustainable management of aquaculture in western Orissa was held at this

Institute during 3-7 November, 2007 sponsored by NR International and Orissa Watershed Development Mission (OWDM). Demonstration and discussions on different aspects of farming including hatchery operation and management, packages of practices of pond management for carp, catfish and freshwater prawn culture were part of the workshop.

Special Day Celebrations

Fish Farmer's Day

The National Fish Farmers Day was celebrated at the Institute on 10 July, 2007. More than 120 fish



National Fish Farmers' Day at CIFA

farmers including 40 women from different districts of Orissa participated in the programme. Dr D. P. Roy, Vice-Chancellor, OUAT presided over the programme. In a scientist-farmer interaction programme, farmers queries on various aspects of freshwater aquaculture was addressed by the scientists. Issues like poor growth of fish, turbidity of pond water, poor spawn recovery, credit and marketing support to fish farmers were discussed. Ten fish farmers from Khurda, Puri, Keonjhar and Kendrapara districts who have achieved success in adopting scientific aquaculture practices, were felicitated on the occasion. Packets containing 1000 rohu fry were distributed free of charge among ten farmers and farm women to encourage them to grow improved fish species.

Environment Day

World Environment Day was celebrated on 5 June, 2007 by planting trees in the Institute campus.

CIFA Foundation Day

The Foundation Day of Institute was celebrated on 5 January, 2008. Dr V. R. P. Sinha, Former Director, CIFA and CIFE was the Chief Guest on the occasion.

National Science Day

The National Science Day was celebrated by conducting a Science Awareness programme with the theme "Understanding the planet earth" and an essay writing competition was organized for the school children of rural high schools at the Institute on 28 February, 2008. A total of 420 students participated in the programme.

Women in Agriculture national Day

Women in Agriculture national Day was celebrated at village Nagpur of Baliana Block, Khurda District on 4 December, 2007 for empowerment of women in latest agriculture technology. Two hundred farm women participated in the programme.

Portable FRP carp hatchery

Operation for SC/ST farmers

Under a project entitled 'Economic and livelihood development of SC/ST through freshwater aquaculture technologies', two portable FRP carp hatcheries were installed and operation demonstrated to the farmers at Tanar village of Kendrapara District and Sirsipal village of Keonjhar District. One hatchery was given to women Self-Help Group (Maa Biswamata SHG) of village Tanar, for upliftment of SC women of that area. Another hatchery was given to a progressive farmer Mr. Manoranjan Giri of village Sirsipal. Fish farmers belonging to scheduled tribes adopted under the project were instructed to train under Mr. Giri, so that they could learn about the operation of the hatchery and adopt spawn rearing as a profession. Induced breeding and spawn rearing of rohu were conducted at village Tanar and Sirsipal, Keonjhar.

Pisciculture for more jobs : Awareness-cum-training programme

In a bid to generate job opportunities among the villagers of Kendrapara district through aquaculture, the Institute organized an awareness-cum-training programme during 31 January - 2 February, 2008. The FRP portable hatchery provided and installed by CIFA in Tanar village under this project is expected to benefit the fishing community since seeds of commercially important fish would be available at a moderate cost. More than 200 people including 35 women participated in the two days programme.

Portable hatchery for better carp seed production

A workshop on 'Portable hatchery for better carp seed production' was organized in collaboration with Orissa Watershed Development Mission and NR International, UK at the Institute during 31 August - 1 September, 2007 to promote capacity building of officials in operation and management of fibre-glass reinforced plastic hatchery. More than 100 delegates from Bolangir, Nuapada, Bargarh and Kalahandi districts of Orissa were given hands on training on different aspects of carp seed production, operation and management of the FRP carp hatchery.

MoU Signed for Consultancy Project

Under the project "Establishment of portable hatchery for the production of quality fish seed in Bargarh District" agreement for the Consultancy services was made between the Management Consultants of the Western Orissa Rural Livelihoods Project (WORLP MC) and CIFA, Bhubaneswar. Under the project, FRP carp hatchery (1 breeding pool, 3 hatching pools, 1 egg collection tank and 1 transportation tank for live fishes) was provided and successfully established at West Utkal Agricultural Center, Diptipur, Bargarh, Orissa. Several training programmes were conducted under the project at Diptipur and Paikmal.

Installation of mini carp hatchery

One unit of FRP mini carp hatchery of estimated spawn production capacity of 0.5 million per operation was installed in the campus of NRC on Women in Agriculture, Bhubaneswar on 30 June, 2008.

Programme on Television/Radio/Video films

Dr B. C. Mohapatra, Sr. Scientist participated in a TV Programme "Machha chasa re plastic ra byabahara (Application of plastics in aquaculture)" for Krushidarsan Programme, Doordarshan (Prasar Bharati) on 21, 23 and 25 January, 2008.

Dr K. K. Sharma, Scientist attended an interactive TV programme (GRAMSAT: Improved pisciculture and post-harvest care) of Directorate of Fisheries, Orissa, Cuttack on 26th February, 2008.

Dr S. K. Swain, Sr. Scientist gave a radio talk on "Atmanijukti pain rangeen machha chasa" (Ornamental fish farming for self-employment) on 4 November, 2008.

Ornamental fish farming for Orissa farmers (2007). A video CD film developed by Gramsat (ORSAC) with technical guidance from CIFA.

Ornamental fish breeding and culture (2008). SAARC video developed by CIFA (ICAR) and SAIC (Dhaka, Bangladesh).

Mega seed project : Seed production in agricultural crops and fisheries

In order to provide quality seed and increase the overall seed production, the ICAR launched a programme to strengthen infrastructural facilities and provide necessary equipment in the form of a mega seed project on 'Seed production in agricultural crops and fisheries' during Xth Five-year Plan with an outlay of Rs. 198.89 crores for 2005-06 and 2006-07. The total out lay for fisheries component amounts to Rs. 16.11 crores that being implemented at 37 centres all over the country. This Institute is the coordinating centre for the fisheries component. The fish seed production of the Institute under this project for 2007-08 is given below.



Fish seed production (in lakhs)

	Carp (spawn & fry)	Catfish	Ornamental fish	Freshwater prawn
Headquarters	544.03	2.90	2.06	4.81
Bangalore Centre	22.78	-	0.75	-

Other extension activities

Programme	Venue	Date	Beneficiaries
Farmers meet (in collaboration with NR International, Bhubaneswar)	WUAC, Diptipur and AJKA, Paikmal, Bargarh District, Orissa	5-6 October, 2007	90
Cage culture harvesting programme	Kuanria Reservoir, Nayagarh, Orissa	1 December, 2007	100
Village level and district level training programmes	Bhagabanpur, Kendrapara District, Orissa	19 January, 2008	100
Demonstration programme on common carp breeding	Tanar Village, Kendrapara district, Orissa	27 January 2008	20
Village level and district level training programmes	B.Ed College, Kendrapara District, Orissa	28 January, 2008	200
Awareness-cum-training programme	Tanar Village, Kendrapara district, Orissa	28-30 January, 2008	20
Training by KVK, CIFA for Anganwadi workers	CIFA, Kausalyaganga	5 February, 2008	40
Demonstration programme on common carp breeding	Sirishpal Village, Keonjhar district, Orissa	5 February 2008	10
Demonstration programme on common carp breeding	Apilo Village, Kendrapara district, Orissa	20 February 2008	15
Free soil & water analysis camp	Bhagabanpur village, Kendrapara District, Orissa	20 February 2008	37
Poultry birds supplied	Block Telkoi, Keonjhar district, Orissa	30 May, 2008	23
Poultry birds supplied	Kendrapara districts	2 June, 2008	5
Breeding of rohu and mrigal in FRP carp hatchery	Village Sirsipal	20 June, 2008	20
Exposure visit for farmers from Telkoi block, Keonjhar district, Orissa	CIFA, Kausalyaganga	26 June, 2008	30
Training programme on Fish value added products for fisherwomen	Dept. of Fisheries ATMA at Khammam	27 June, 2008	400



EDUCATION AND INFORMATION SYSTEM

Library

Dr. Hiralal choudhury Library subscribed 37 International and 64 Indian Journals during the year. Total 433 books were procured during the year 2007-2008. The library has been recognised as the FAO Depository Library. The Library has the AGRIS CD-ROM from 1975 to May 2001 and Current Content CD-ROM: Reference Edition of Life Sciences and Agriculture, Biology and Environmental Sciences for 1999 and 2000. All the ASFA, AGRIS, AGRICOLA & Current contents CDs that are available in the institute have already been mirrored in the CD/DVD mirror server and all the above databases are accessible through LAN. The library provides monthly 'Current Contents' service by compiling content pages of current journals received and also provides photocopy facility. Besides the 2500 internal users (which includes scientists, research scholars, & M.F.Sc. students) of the library, 586 visitors from outside organisations utilised the library resources.



Library Automation

Libsys software is installed and the Circulation and OPAC module are in operation.

Planning, Monitoring and Evaluation Cell

During the year under report, the Planning, Monitoring and Evaluation Cell undertook the following work:

- 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 SRC, RAC and QRT meetings
- Correspondence with ICAR, ICAR Fisheries Institutes, SAU's and other organizations on various research issues
- Maintenance of Research Project Files
- Six-monthly assessment reports of scientific staff
- Action taken reports on recommendations of ICAR Regional Committee Meetings

Communication of reports

- Material for DARE-ICAR Annual Report 2007-08
- 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

Publications

- Annual Report of the Institute for 2006-07
- CIFA News Vol. 14 (No. 2, 3, 4); Vol. 15 (No. 1)



Release of Oriya booklets by Sri K. Sahoo IAS, Collector-cum-District Magistrate, Kendrapara





AWARDS AND RECOGNITIONS

Receipient	Award	Venue	Year
Dr. S. Adhikari, Senior Scientist	XII International Science Commemoration Award	72 nd Annual Convocation of the Indian Society of Soil Science, Birsa Agricultural University, Ranchi	2 November, 2007
Dr S. K. Swain, Senior Scientist	Fellow of Zoological Society of India	Bodhgaya	5 November, 2007
Dr. B. K. Mishra, Principal Scientist	Dr.M.C.Dash Gold Medal of Zoological Society of India	All India Congress of Zoology, Lucknow	7-9 December, 2007
Dr H. K De, Scientist (SS)	Young Scientist Award of Indian Society of Extension Education	National Seminar at University of Agricultural Sciences, Dharwad	18-20 December, 2007
Dr A.K. Pandey, Senior Scientist	Eminent Scientist of the Year Award 2007 of the National Environmental Science Academy (NESA)	XXth Annual Session of the Academy, Jamia Hamdard University, New Delhi	27-29 December, 2007
Dr A.K. Pandey, Senior Scientist	Fellow of the National Environmentalists Association	Ranchi	28 January, 2008
Dr A.K. Pandey, Senior Scientist	Dr. S.Z. Qasim Gold Medal of Bioved Research Society, Allahabad	10 th Indian Agricultural Scientists and Farmers Congress, Allahabad	16-17 February, 2008
Sri P. Jena, Private Secretary	Distinguished Service Award 2008 of Bioved Research Society, Allahabad	10 th Indian Agricultural Scientists and Farmers Congress, Allahabad	16-17 February, 2008

Academic Accomplishments/Recognitions

Mr. D. K. Verma was awarded PhD degree on 7th February, 2008 for his thesis entitled "Study on functional efficacy of testis and cryogenic preservation of male gametes of mrigal, *Cirrhinus mrigala* (Ham.)". He worked under the supervision of Dr.P.Routray, Senior scientist, CIFA.

The Director, CIFA, Project Leader, and the team members of the consultancy project "Setting up a portable FRP carp hatchery in Bargarh District" received a Letter of Appreciation from Western Orissa Rural Livelihoods Project (WORLP) and NR International for Outstanding support for installation and operation of FRP carp hatchery in Diptipur, Bargarh District.

Dr. P. Routray was felicitated for his distinguished achievements and contributions in the field of "Stem Cell Biology" at a UGC-sponsored seminar on "Stem Cells and its Clinical Applications" held at S. N. College, Kendrapara, Orissa during 19-20 January, 2008.

CIFA Annual Day

The Annual Day of the Institute was celebrated on

1st April, 2007. On the occasion, Dr A. Samanta, Vice-Chancellor, KIIT, Bhubaneswar was the Chief Guest and Dr I. C. Mahapatra, Ex-Vice-Chancellor, OUAT and Dr V. L. Bhowmik, were the Guests of Honour. The CIFA Annual Awards for the year 2005 instituted from the interest accrued on the cash prize of ICAR Best Institution Award, 1996 were conferred on the following staff members of the Institute.

Best Division	: Division of Aquaculture Production and Environment
Best Young Scientist	: Dr. P. Routray Dr S. K. Sahoo
Best Technical Person	: Sri Ajaya Kumar Dash
Best Administrative Person	: Ms Singa Soren
Best Supporting Staff	: Shri G. Adinarayan Shri Golakha Parida
Best Extension Worker	: Dr. S. K. Swain Dr H. K. De
Best Research Scholar	: Shri Surjya Narayan Dash
Best Hindi Worker	: Shri Sisir Kumar Mohanty

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 Research Advisory Committee meeting (2006-07) was held during 11-12 April, 2007 under the Chairmanship of Dr Ambekar E. Eknath with Dr P. K. Aravindakshan, Dr Gunindra N. Chattopadhyay, Mr. Devanga S. Ananth as Members and Dr A. K. Sahu, Principal Scientist, CIFA as Member-Secretary. Two other RAC members, Dr Sopore and Dr P. Kumar could not be present due to engagements elsewhere. This was the first meeting of the RAC constituted by ICAR in November 2006 for a period of three years from February 1, 2007 to January 31, 2010. The second meeting of the RAC (2007-08) was held during 12-13 February, 2008.

Staff Research Council

The Staff Research Council meeting was held during 19-21 April, 2007 under the Chairmanship of Dr N. Sarangi, Director, CIFA. Dr V. V. Sugunan, ADG (I.Fy), ICAR presided over the meeting and offered his valuable guidance. The progress of Institute-based and externally funded projects during 2006-07 were discussed and the research portfolio for 2007-08 was finalized.

Management Committee

The 28th Institute Management Committee meeting was held on 7 December, 2007 under the Chairmanship of Dr N. Sarangi, Director, CIFA which was attended by Dr D. P. Ray, Vice Chancellor, OUAT, Bhubaneswar, Sri D. S. Ananth, Dr P. Kumariah, Pr. Scientist, CIFA, Dr Madan

Mohan, Pr. Scientist, NRCCF, Bhimtal, Dr N. K. Mukhopadhyay, Pr. Scientist, CIFRI, West Bengal, Dr (Ms) Aparna choudhury, Sr. Scientist, CIFE, Mumbai, Shri P. C. Nayak, F&AO (I/C), CRRI, Cuttack and Sri S. Purkayastha, AO, CIFA as Member Secretary. Agenda items included confirmation of proceedings of 27th meeting, approval of equipments proposed to be procured during 2007-08, completion of post-graduate hostel, regularization of excess expenditure incurred under sponsored project (UNIFEM).

Review meeting on Mega seed project

Since CIFA is the nodal center for the fish seed component of the mega seed project, a review meeting was held during 24-25 September, 2007 under the Chairmanship of Dr S. Ayyappan, DDG (Fy), ICAR. The meeting was attended by over 50 researchers from 35 centres where the fish seed project is underway. The project is expected to provide quality seed including improved varieties through networking mode to the fish farmers. Dr N. Sarangi, Director, CIFA, Dr V. V. Sugunan, ADG(Fy), ICAR and Dr T. K. Srivastava, Directorate of Seed Research, Mau, Uttar Pradesh spoke on the occasion.

Scientific Advisory Committee Meeting (KVK)

The fifth Scientific advisory committee meeting of KVK was held on 28 March, 2008 under the Chairmanship of Director, CIFA for review of the work done during 2007-08 and finalization of the action plan for 2008-09

Idea generation workshop in Aquaculture Biotechnology

In a bid to identify research priority in aquaculture biotechnology for the Eastern region, a workshop sponsored by Dept. of Biotechnology, Govt. of India on Idea generation in Aquaculture Biotechnology was organized at the Institute during 26-27 September, 2007. It was attended by over 50 researchers and academicians engaged in biotechnology research and education from West Bengal and Orissa. Dr George John, Sr. Advisor, DBT inaugurated the workshop.



Trainees at work in the laboratory

Dr Kshitish Majumdar and Dr Satish Kumar from Centre for Cellular and Molecular Biology, Hyderabad, Dr A. K. Panda from National Institute of Immunology, New Delhi and Dr P. L. Nayak from SPC Biotech Pvt. Ltd., Hyderabad spoke in the plenary session of the workshop. Dr N. Sarangi, Director, CIFA, Dr A. K. Rawat, DBT and Dr P. K. Mukhopadhyay, CIFA also spoke on the occasion.

Group monitoring meeting of Dept. of Science and Technology

The group monitoring meeting of Dept. of Science and Technology (GoI) on 'Women in science and technology' was organized at the Institute during 10-12 October, 2007.

Workshop-cum-training on Application on molecular genetics in aquaculture and inland fisheries management

A Workshop-cum-training on Application of molecular genetics in aquaculture and inland

fisheries management jointly organized by NACA-CIFA-FAO was held at the Institute during 27 November - 4 December, 2007. This event is recognition for this Institute as the Regional Lead Centre in India of NACA. There were 10 participants from Nepal, Sri Lanka, Bangladesh and India. Prof. Sena De Silva, Director General, NACA inaugurated the workshop, while Dr T. Nguyen, Coordinator, Genetic Biodiversity Programme, NACA was the resource person from NACA.

Workshop on 'Genetic improvement of freshwater prawn, Macrobrachium rosenbergii (DeMan) in India'

The first workshop of the Bilateral project between CIFA and World Fish Centre on 'Genetic improvement of freshwater prawn, Macrobrachium rosenbergii (DeMan) in India was held at the Institute during 17-19 March, 2008.



Inaugural session of the workshop



HUMAN RESOURCE DEVELOPMENT

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

Events/Training	Venue	Period	Participant(s)
Third special training for Eastern region ICAR Institute Directors on Vigilance administration and management	CRRI, Cuttack	16-18 April, 2007	N. Sarangi
Training on LIBSYS software (3 rd Level)	Libsys Corporation, Regional Office Kolkata	21-26 May 2007	S. K. Mohanty
Training on Building institutional repositories using GNU eprints	NCSI, IISc, Bangalore	1 st -3 August, 2007	S. K. Mohanty
Hands on training on Programme for intelligent reporting system (IRS)	NAARM, Hyderabad	30-31 August, 2007	Nirupama Panda
Improving administrative efficiency and financial management	NAARM, Hyderabad	13-20 November, 2007	P.K.Ghosh
Advances in aquaculture technologies	CIFE, Mumbai	8-28 January, 2008	Lopamudra Sahoo
Training on Basic techniques in stem cell biology: Isolation, maintenance and differentiation	Centre for Cellular and Molecular Biology, Hyderabad	25 February-10 March 2008	P. Routray

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

Events	Venue	Duration	Participant(s)
FET programme conducted by FOCARS probationers	Nagpur	5 April, 2007	R.N. Mandal
National seminar on Stem cell therapy- Hope or Hype	S.C.B. Medical College, Cuttack	7 April, 2007	P. Routray
Final workshop of the project 'Achieving greater food security and eliminating poverty by dissemination of genetically improved carp strains to fish farmers'	Hanoi, Vietnam	3-6 April, 2007	N. Sarangi K. D. Mahapatra
Workshop on Nature of dissemination and impact of <i>Jayanti</i> rohu in India	CIFRI, Barrackpore	15 April, 2007	N. Sarangi K. D. Mahapatra B. S. Giri J. N. Saha
Meeting on North-East development programme on aquaculture	Guwahati	20-22 April, 2007	A.K. Sahu
Workshop on Coastal Regulation Zone	NALSAR University of Law, Hyderabad	20-22 April, 2007	P. Kumaraiah
FAO/NACA/Govt. of Indonesia workshop on the Promotion of Aquaculture Insurance in Asia	Bali, Indonesia	30 April - 2 May, 2007	N. Sarangi
Meeting of AICRP on APA	CIPHET, Ludhiana	2 May, 2007	B. C. Mohapatra
18 th Governing Council Meeting of NACA	Bali, Indonesia	3-5 May, 2007	N. Sarangi
Task Force Meeting of Department of Biotechnology (GoI)	New Delhi	17-18 May, 2007	N. Sarangi
Closure workshop relating to Indo-Norwegian projects	Oslo, Norway	29 May, 2007	N. Sarangi
Meeting on Remote sensing for resource survey on aquaculture	Hyderabad	7 June, 2007	N. Sarangi
Resource person for TCDC course on Aquaculture	FFRC/RRLC, Wuxi, China	7-10 June, 2007	J. K. Jena
Meeting of Directors of ICAR Fisheries Institutes	S.V. University, Tirupati	9-10 June, 2007	N. Sarangi
Sensitization programme	Guwahati	2-10 July, 2007	B. S. Giri
Indo-US Workshop on "Brackish water aquaculture production systems and environmental management"	CIBA, Chennai	10-11 July, 2007	S. Adhikari
Conference on Applied zoology and sustainable development	IICT, Hyderabad	13-14 July, 2007	A. K. Pandey

Workshop on Partnerships for reservoir fisheries development	CIAE, Bhopal	27-28 July, 2007	N. Sarangi
Special interactive workshop on Administrative and financial matters	CRIJAF, Barrackpore	2 August, 2007	N. Sarangi
Meeting on network project on Impact assessment of fisheries research in India	CIBA, Chennai	2-3 August, 2007	A. K. Roy H. K. De
XV meeting of extension council of CIFE	CIFE, Mumbai	4 August, 2007	N. Sarangi
Conference on Genetics and aquaculture session of the World Aquaculture Society	Hanoi, Vietnam	5-8 August, 2007	K. D. Mahapatra
Workshop on Creative excellence for individual development and organizational growth	NAARM, Hyderabad	6-10 August, 2007	P. V. Rangacharyulu
ICAR/NACA workshop on "Aquatic epidemiology, surveillance and emergency preparedness"	CIBA, Chennai	3-7 September, 2007	P.K. Sahoo
National seminar on 'Application of engineering principle and mathematical modeling in food processing'	CIPHET, Ludhiana	7 August, 2007	K. K. Sharma
Meeting of IJSC	RRC of CIFA, Vijayawada	17 September, 2007	N. Sarangi A. K. Prusty
Task force meeting	DBT, New Delhi	18-19 September, 2007	N. Sarangi B. C. Mohapatra
Workshop on "Modern extraction techniques/sample preparation"	OUAT, Bhubaneswar	8 October, 2007	S. Adhikari
Workshop on Integrated farming system	OUAT, Bhubaneswar (organized by MSSRF)	9 October, 2007	B. C. Mohapatra
Fourth meeting of Task force on Aquaculture and Marine Biotechnology	New Delhi	10-11 October, 2007	N. Sarangi
Conference on Aquaculture Europe 2007 organized by the European Aquaculture Society and Review meeting of Aquamax Project	Istanbul, Turkey	23-28 October, 2007	N. Sarangi S. N. Mohanty S. S. Giri
V th Zonal workshop on Fisheries and aquaculture policy: Sustainable development to livelihoods prospects for central status	Patna	25-27 October, 2007	Dr P. Kumaraiah
Symposium on Biomarkers of environmental problems	Department of Zoology & Environmental Sciences, Ch. Charan Singh University, Meerut	26-28 October, 2007	A.K. Pandey

Workshop of All India Coordinated Research Project (AICRP) on Application of Plastics in Agriculture'	VPKAS, Almora	26-28 October, 2007	B. C. Mohapatra S. P. Mohanty K. K. Sharma
International Symposium on 'Management on coastal ecosystem: technological advancement and livelihood security' organized by Indian Society of Coastal Agriculture	Science City Kolkata	27-30 October, 2007	A. K. Datta N. M. Chakraborty S. P. Rai B. N. Paul B. K. Pandey S. C. Mondal
Review meeting of DBT regarding BTIS Centre	New Delhi	29 October, 2007	A. K. Roy
72 nd Annual Convention of Indian Society of Soil Science.	Birsa Agricultural University, Ranchi, Jharkhand	2-5 November, 2007	S. Adhikari
Review meeting on Proposed cage culture projects in reservoir in Andhra Pradesh	Andhra Pradesh	5-6 November, 2007	P. Kumaraiah
Workshop on Key stakeholders for promotion of ornamental fish production	UAS, Bangalore	7 November, 2007	M. R. Raghunath
8 th Asian Fisheries Forum	Kochi	20-23 November, 2007	N. Sarangi P. Kumaraiah J. K. Jena P. Jayasankar A.K.Datta K. D. Mahapatra B. R. Pillai S. Adhikari B.N.Paul B. C. Mohapatra S. K. Swain
Workshop on 'Functional Genomics and Evolutionary Biology'	Institute of Life Sciences, Bhubaneswar	21-23 November, 2007	P.K. Sahoo
31 st Annual Convention of Bhubaneswar Chapter of Indian Society of Soil Science	WTCER, Bhubaneswar	4 December, 2007	S. Adhikari
Workshop on Rajbhasha Kaaryanvayan men, Rajbhasha Adhkariooyon ki Samasyayen	NAARM, Hyderabad	4-6 December, 2007	Bikash Sarkar
FAO consultant on Advisory mission on genetic improvement of cultured carps	Nepal	06-26 December, 2007	K. D. Mohapatra
6 th Congress of Asia-Oceania Society for comparative endocrinology	North Bengal University, Siliguri, West Bengal	10-14 December, 2007	P. K. Mukhopadhyay J. Mohanty S. Nandi
International conference on Emerging and re-emerging viral diseases of the tropics and sub-tropics	IARI, New Delhi	11-14 December, 2007	P.K. Sahoo

National Farmers Conference	Hyderabad	12-13 December, 2007	B. S. Giri
Ecosystem health and fish for tomorrow	CIFRI, Barrackpore	14-16 December, 2007	N. Sarangi A. K. Datta S. P. Rai N. M. Chakrabarty P. P. Chakrabarty B. N. Paul B. K. Pandey S. C. Mandal S. Sahu
Seminar on 'WTO negotiations and its implications for India'	Bhubaneswar	9-10 January, 2008	N. Sarangi
ATMA governing body meeting	Collectorate, Khurda	11 January, 2008	B. Behera
21 st meeting of the ICAR Regional Committee No.8	CTCRI, Thiruvananthapuram	11-12 January, 2008	M. R. Raghunath
Workshop on Confocal Microscopy	Institute of Life Sciences	14-16 January, 2008	P. Routray
International Seminar on Ornamental fish breeding, farming and trade	Dept of Fisheries, Govt of Kerala, Cochin	2-3 February, 2008	S. K. Swain
Ornamental fish buyer seller meet	Dept of Fisheries, Govt of Kerala, Cochin	4 February, 2008	S. K. Swain
Mid-term review meeting of ICAR Regional Committee No-II	CIFRI, Barrackpore	5 February, 2008	N. Sarangi
IPR related program	NAARM, Hyderabad	14-16 February, 2008	P. K. Mukhopadhyay
10 th Indian Agricultural Scientists and Farmers Congress	ISDC, University of Allahabad	16-17 February, 2008	A. K. Pandey P. Jena
Brainstorming session to prepare BMP's for scampi hatchery	Nellore	21-22 February, 2008	B. R. Pillai
Review meeting of the Mega seed project of ICAR	NRCCWF, Bhimtal	22-23 February, 2008	N. Sarangi S. K. Swain
Coordination Committee Meeting of AICRP on APA	Central Institute of Post-Harvest Engineering and Technology, Abohar, Punjab	22-23 February, 2008	B. C. Mohapatra Bikash Sarkar
7 th Coordination committee meeting	Bhubaneswar	25 February, 2008	L. Safui
Workshop on 'WORTIC & WOBIC' at Central Facility for Marine Cyanobacteria	Bharathidasan University, Tiruchirapally, Tamilnadu	3-7 March, 2008	R. N. Mandal
Third EFC meeting of DARE/ICAR (Xith Plan)	New Delhi	4 March, 2008	N. Sarangi
19 th Governing Council Meeting of NACA	Kathmandu, Nepal	5-9 March, 2008	N. Sarangi

Seminar on Environmental Control for Plants, Animals and Fisheries	Central Institute of Post-Harvest Engineering and Technology, Abohar, Punjab	15-16 March, 2008	B. C. Mohapatra Dr S Mohanty
Indo-US Agricultural Knowledge Initiative Joint workshop on Harnessing the benefits of biotechnology	NASC, New Delhi	27 March, 2008	P. K. Sahoo
International seminar on Giant Malaysian prawn-2008	Kuala Lumpur	28-29 March, 2008	K. D. Mahapatra B. R. Pillai
Visit to World Fish Centre	Penang, Malaysia	31 March-3 April, 2008	K. D. Mahapatra B. R. Pillai



World Environment Day, 5th June 2007



EXHIBITIONS

The Institute participated in the following exhibitions during 2007-08

Exhibition	Venue	Period
Folk Fair	Puri, Orissa	12-13 May, 2007
Indian National Development Festival	Bhubaneswar	1-8 July, 2007
Eleventh National Expo	Kolkata	7-14 September, 2007
8 th Asian Fisheries Forum	Kochi	20-23 November, 2007
Matsya Mahatsav-2007	CIFRI, Barrackpore	14-16 December, 2007



Dr. S. Ayyappan, DDG (Fy) at the ICAR stall at Dimapur Expo



BUDGET

A. Provision from the ICAR (2007-2008)

(Rs. In lakhs)

Sl. No.	Sub-head	Non-Plan		Plan	
		Provision made in RE 2007-2008	Expenditure	Provision made in RE 2007-2008	Expenditure
1.	A) Establishment charges	590.00	589.62		
	B) Wages	24.00	24.16		
	C) OTA	0.20	0.20		
2.	Traveling allowances	9.00	9.00	20.00	20.00
3.	HRD			5.00	2.65
4.	A) Other charges including equipments	100.80	100.65	372.00	370.85
	B) Cyclone, damage restoration				
5.	Works	35.00	34.91	120.00	120.00
6.	Information Technology			20.00	20.00
7.	Others			5.00	4.61
8.	A) Catch-up grant equipment				
	B) Catch-up grant building				
	C) NEH			50.00	49.99
Total (1-8):		759.00	758.54	592.00	588.10

B. Provision from other agencies(2007-2008)

Agency	Expenditure	Agency	Expenditure	Agency	Expenditure
BTIS	9.76	Pension & Gratuity	78.59	ICAR National Fellow	9.28
ICAR/AP Cess	36.17	ICAR/APA	1.89	P Loans & Advances	15.00



DISTINGUISHED VISITORS

Kausalyaganga, Bhubaneswar

- Dr S. Ayyappan, DDG (Fy), ICAR (24-25 September, 2007)
- Dr George John, Sr. Advisor and Dr A. K. Rawat, Pr. Scientific Officer, DBT, New Delhi (26-27 September, 2007)
- Prof. Sena De Silva, DG, NACA and Dr T. Nguyen, Coordinator, Genetic Biodiversity Programme, NACA (27 November - 4 December, 2007)
- Dr S. Ayyappan, DDG (Fy), ICAR. A function was organized on the occasion for opening the CIFA Aquarium to the public (25-26 January, 2008)
- Dr Patrick Herpin, Scientific Director for Animal Products and Dr S. J. Kaushik, Head Joint Research Unit for Fish Nutrition, Aquaculture and Genomics, Animal Physiology Division, INRA, France (6-7 March, 2008)

Regional Research Centre of CIFA, Vijayawada

- Sri Mandali Buddha Prasad, Hon'ble Minister for Fisheries and Sri N. Narasimha Rao, IAS, Commissioner of Fisheries, Govt. of Andhra Pradesh (9 May, 2007)
- Hon'ble Minister for Fisheries and Animal Husbandry, Govt. of Andhra Pradesh Sri M. Buddha Prasad along with Hon'ble Minister of Fisheries, Govt. of Tamil Nadu (6 December, 2007)
- Dr S. Ayyappan, DDG (Fy), ICAR (16-18 January, 2008)

Regional Research Centre of CIFA, Bangalore

- A team of eight government officials from Senegal and Ghana accompanied by officials from the Tata Energy and Resources Institute (Southern Regional Center) to familiarize themselves with aquaculture and its potential for developing countries (22 October, 2007)

Wastewater Aquaculture Division of CIFA, Rahara

- Dr. Mangala Rai, Secretary, DARE and Director General, ICAR, along with Dr. S. Ayyappan, DDG (Fisheries), ICAR; Dr. N. Sarangi, Director CIFA and Dr. H. S. Sen, Director, CRIJAF, Nilganj, Barrackpore (16 December, 2007)

PUBLICATIONS

Research papers

- Adhikari, S., B. Sarkar, A. Chattopadhyay, D. N. Chattopadhyay, S. K. Sarkar and S. Ayyappan, 2008. Carbofuran induced changes in breeding of a freshwater fish, *Labeo rohita* (Ham.). *Toxicol. Environ. Chem.*, 90: 457-465.
- Adhikari, S., L. Ghosh and S. Ayyappan, 2007. Effect of calcium hardness on toxicity and accumulation of water-borne lead, cadmium and chromium to *Labeo rohita* (Ham.). *Asian J. Water, Environ. Poll.*, 4: 103-106.
- Adhikari, S., V. S. Chaurasia, A. A. Naqvi and B. R. Pillai, 2007. Survival and growth of *Macrobrachium rosenbergii* (de Man) juvenile in relation to calcium hardness and bicarbonate alkalinity. *Turkish J. Fish. Aquatic Sc.*, 7: 23-26.
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LIST OF APPROVED ON-GOING PROJECTS

Institute-based projects

Sl. No.	Project Code	Title of the project	Project leader	Duration
1.	I-41	Ornamental fish breeding and culture	S. K. Swain	April 2004 - March 2008
2.	I-43	Qualitative and quantitative assessment of gonad and gametes of Indian major carps through induced breeding with GnRH-based inducing agents and carp pituitary extract	P. Routray	April 2004 - March 2008
3.	I-45	Study of fish biodiversity, breeding and culture of carps and some selected ornamental fishes in North-eastern states of Meghalaya	N. M. Chakraborty	April 2004 - March 2008
4.	I-47	Development of sustainable seed production and culture technologies of <i>Macrobrachium</i> species	Radheyshyam	
		a) Development of technological packages for grow-out culture of Ganga river Prawn <i>Macrobrachium gangeticum</i>	Radheyshyam	April 2005 - March 2009
		b) Mono and polyculture of freshwater prawn for technology refinement at rural front	Radheyshyam	April 2004 - March 2008
5.	I-48	Large-scale seed production of <i>Ompak</i> and <i>Mystus</i> spp. and study of growth performance of <i>Ompak pabda</i> and <i>Mystus vittatus</i> using different diet under variable physico-chemical condition	N. M. Chakraborty	April 2005 - March 2008
6.	I-50	Development of primary cell culture derived from carp fin, liver, kidney and prawn larvae	N. K. Maiti	April 2005 - March 2008
7.	I-51	Physiological mechanism of early maturation and multiple breeding of Indian major carps and <i>H. fossilis</i>	A. K. Pandey	April 2005 - March 2008

8.	I-52	Feed formulation for nutritional responses in selected freshwater fish	S. N. Mohanty	April 2005 - March 2008
		a) Low cost feed formulation and feeding of improved carp		
		b) Feed formulation and feeding of <i>Clarias batrachus</i> and <i>Horabagrus</i> catfishes		
		c) Feed development for <i>Ompak pabda</i> and <i>Mystus seenghala</i>		
		d) Feed development of important minor carps		
e) Studies on feed development for medium carps of peninsular region				
9.	I-53	Differential hormonal gene expression during reproduction in Indian major carp, <i>Labeo rohita</i>	S. K. Sarkar	April 2006 - March 2009
10.	I-54	Diversification in freshwater aquaculture for sustainable production		
		a) Nutrient budgets in freshwater fish pond	S. Adhikari	April 2006 - March 2009
		b) Cage aquaculture and its impact on the ecosystem	P. Kumaraiah	April 2006 - March 2008
		c) Water budget modeling of freshwater fish pond under warm and humid climate	K. K. Sharma	April 2006 - March 2009
		d) Farming of freshwater climbing Perch, <i>Anabas testudineus</i> (Bloch) and development of technological package	Kuldeep Kumar	April 2006 - March 2009
		e) Culture of striped murrel, <i>Channa striatus</i> and development of practices and package	Kuldeep Kumar	April 2006 - March 2009
		f) Freshwater pearl mussel culture	Kuldeep Kumar	April 2006 - March 2009
		g) Characterization of growth pattern of diversified carp species under monoculture	P. C. Das	April 2007 - March, 2010
		h) Influence of nutrients factor on growth performance of <i>Eichhornia crassipes</i> and <i>Vallisneria spiralis</i>	R. N. Mandal	April, 2007 - March, 2010
		i) Design, development and performance evaluation of improved mechanized fish harvesting system for aquaculture pond.	K. K. Sharma	April, 2007 - March, 2010
		j) Mass seed production and growout culture of diversified catfishes: <i>Pangasius pangasius</i> and <i>Horabagrus brachysoma</i>	S. K. Sahoo	April, 2007 - March, 2010
		k) Breeding and culture of <i>R. corsula</i> and its incorporation in polyculture	Radheyshyam	April, 2007 - March, 2010
l) Stock comparison and development of base population of giant freshwater prawn <i>Macrobrachium rosenbergii</i>	Bindu R. Pillai	April, 2007 - March, 2009		
11.	I-55	Impact of training programmes on freshwater aquaculture conducted by CIFA	H. K. De	April, 2007- March, 2009

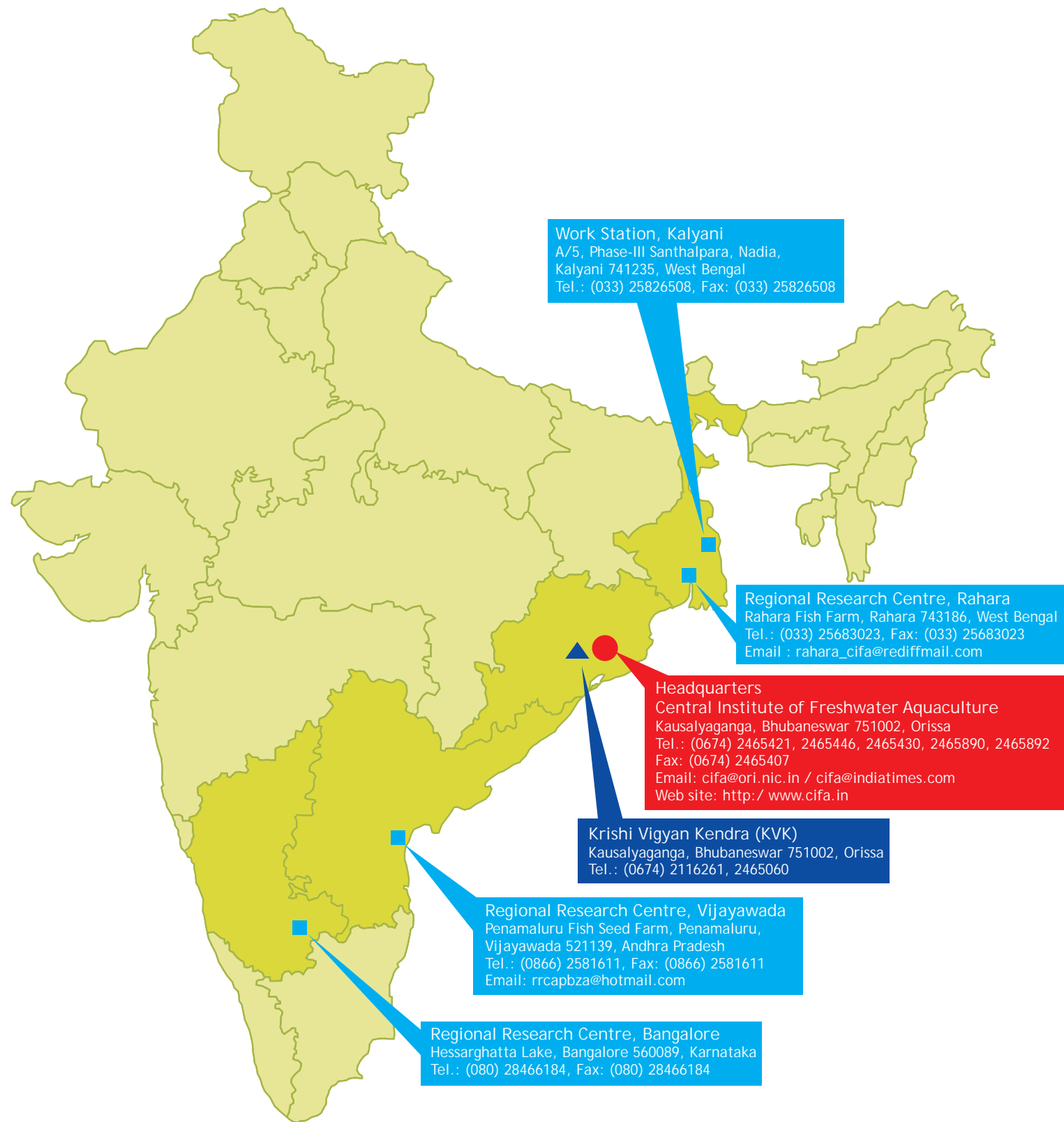
12.	I-56	Improving production efficiency in Aquaculture through integrated nutrient management	P. V. Rangacharyulu	April, 2007 - March, 2010
13.	I-57	Immune responses in carps with particular reference to immune related genes	B. K. Das	April, 2007 - March, 2010
		a) Cloning and sequencing of Interferon Inducible genes of <i>Labeo rohita</i>		
		b) Studies on immune responses in <i>Puntius sarana</i>	P. K. Sahu	April, 2007 - March, 2009
14.	I-58	Investigations on the efficacy of commercial Lactic Acid Bacteria as Freshwater fish/shellfish probiotics	S. Mohanty	April, 2007 - March, 2010
15.	I-59	Genetic upgradation of freshwater fish and shellfish	P. K. Mukhopadhyay and P. Jayasankar (from 2 nd January, 2008)	April, 2007 - March, 2010
		a) Genetic improvement of rohu for growth and disease resistance against <i>Aeromonas hydrophila</i> through sustainable selective breeding		
		b) Development of DNA markers in <i>M. rosenbergii</i> and Jayanti families		
		c) Studies on gene expression of i) vitellogenin; and ii) PUFA synthesizing enzymes in rohu		
		d) In vitro culture of stem cell of freshwater fishes		
16.	I-60	Aquaculture diversification and wastewater management	A. K. Datta	April, 2007 - March, 2010
17.	I-61	Photothermal manipulation on neuroendocrine regulated reproduction in carp, <i>L. rohita</i> under controlled environment	S. K. Sarkar	April, 2007 - March, 2010
18.	I-62	Propagation of selected peninsular/ indigenous fishes for incorporation in to aquaculture and modification of aquaculture practices for water deficient regions	M. R. Raghunath	April, 2007 - March, 2010
19.	N-1	Network Project on Germplasm exploration, cataloguing and conservation of fish and shellfish resources of India	N. Sarangi	April, 2006 - March, 2009
		a) Breeding and culture of Mahanadi mahseer, <i>Tor mossal mahanadicus</i> (David)		

Externally funded projects

Sl. No	Project Code	Title of the project	Funding agency	Project leader	Duration
1.	E-01	Biotechnology Information System Network (BTISnet)	Dept. of Biotechnology, Govt. of India	A.K. Roy	Continuous
2.	E-03	Application of Plastics in Aquaculture	AICRP, ICAR	B. C. Mohapatra	Continuous
3.	E-25	Evaluation of production performance of a few medium carp species under mono and polyculture systems	ICAR AP Cess Fund Scheme	J. K. Jena	May, 2004 – May, 2008
4.	E-26	Vitellogenin and its molecular expression in catla	ICAR AP Cess Fund Scheme	S. Nandi	November, 2004 – February, 2008
5.	E-27	Cryopreservation of primordial germ cells and embryonic cells of Indian major carps and their utilization in aquaculture biotechnology	ICAR AP Cess Fund Scheme	P. Routray	November, 2004 – February, 2008
6.	E-28	Refinement of hatchery technology for seed production of Gangetic prawn <i>Macrobrachium gangeticum</i> (Bate) synonym <i>Macrobrachium birmanicum choprai</i> (Tiwari)	ICAR AP Cess Fund Scheme	Radheyshyam	2004 – November, 2007
7.	E-29	Molecular characterization of backcross population of Indian major carps viz., <i>Labeo rohita</i> and <i>Catla catla</i>	ICAR AP Cess Fund Scheme	N. Sarangi	December, 2004- December, 2007
8.	E-30	Kinetics of macromolecular cleavage in relation to nutrient availability in the peninsular carp <i>Labeo fimbriatus</i>	ICAR AP Cess Fund Scheme	N. Sridhar	May, 2004 – August, 2007
9.	E-31	Biochemical studies on <i>Lernaea</i> species affecting peninsular fishes with an aim on development of reliable prophylactic and control measures against the parasite	ICAR AP Cess Fund Scheme	Hemaprasanth	February, 2005 – January, 2008
10.	E-32	Development of technology of seed production and culture of feather back, <i>Notopterus chitala</i> and two medium carps, <i>Labeo gonious</i> and <i>L. fimbriatus</i> for diversification of freshwater aquaculture	ICAR National Fellow Scheme	J. K. Jena	January, 2005 – January, 2010
11.	E-33	Achieving greater food security and eliminating poverty through dissemination of improved carp strains	World Fish Centre, Malaysia	N. Sarangi	April, 2005 – April, 2008
12.	E-34	Development of protocol for organic farming of carps and freshwater prawns	ICAR AP Cess Fund Scheme	J. K. Jena	August, 2005 – August, 2008

13.	E-35	Sustainable aquafeeds to maximize the health benefits of farmed fish for consumers (AquaMax)	European Commission	S. N. Mohanty	January, 2007 – February, 2010
14.	E-36	Economic and livelihood development of SC/ST population through freshwater aquaculture technologies	Dept. of Biotechnology, Govt. of India	N. Sarangi	April, 2006 – March, 2009
15.	E-37	Application of microorganisms in agriculture and allied sectors (NBAlM); Sub-project: Microbial diversity and identification	NBAIM, Mau	N. K. Maiti	April, 2006 – March, 2008
16.	E-38	Impact Assessment of Fisheries Research in India	ICAR AP Cess Fund Scheme	H. K. De	April, 2006 – October, 2008
17.	E-39	Studies on association of viral infections in diseases of Koi carps by immunological and molecular techniques	ICAR AP Cess Fund Scheme	P. Swain	
18.	E-40	Utilization and recycling of palm oil mill effluent- Evaluation of POS in fish feed (Collaborative Project with NRC OIL Palm, Pedavegi)	ICAR AP Cess Fund Scheme	M. Kochu Babu (NRC, Oil Palm) (PI), P. V. Rangacharyulu (Co-PI)	November, 2004 – Continuing
19.	E-41	Isolation, purification and characterization of active components from amoebocytes of Indian horseshoe crabs for developing suitable diagnostics	DST Fast Track Scheme, Govt. of India	S. K. Nayak, P. Swain (Mentor Scientist)	May, 2006 – April, 2009
20.	E-42	Genetic improvement of freshwater prawn, <i>Macrobrachium rosenbergii</i> (de Man) in India	World Fish Centre, Malaysia	Bindu R. Pillai, Sr. Scientist	April, 2007 – March, 2009
21.	E-43	A comprehensive study on argulosis: Host-parasite interaction with respect to modulation of innate and specific immune responses, and development of preventive or control measures	National Fund on Basic and Strategic Research in Agriculture	P. K. Sahoo, Sr. Scientist	December, 2007- January, 2012

RESEARCH LOCATION



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(2007-2008)



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 1. #eAe DeAve e keAve, j n j e-743186, HeA/zece yeAve
 2. #eAe DeAve e keAve, keA³ee e-741235, HeA/zece yeAve
 3. #eAe DeAve e keAve, n me j l ee e
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 4. #eAe DeAve e keAve, HeAve e e^a,
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