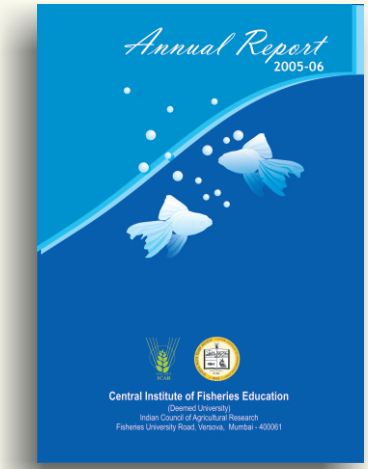
Annual Report
2005-06

Central Institute of Fisheries Education

(Deemed University)

Indian Council of Agricultural Research

Fisheries University Road, Versova, Mumbai - 400061



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Publisher:

Director
Central Institute of Fisheries Education, Mumbai

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Contents

1 Preface

The year 2005-06 was one of the momentous years in the journey of CIFE. With commitment and zeal, it contributed towards the larger goal of enhanced food and nutritional security by generating qualified and skilled human resource in fisheries sector. Quality research in basic and frontier areas of fisheries sciences was conducted with renewed focus and in a multi-disciplinary approach. While capacity building of the faculty members of fisheries colleges under SAUs and fisheries officers of various State Departments of Fisheries has received priority attention, the strategies and approaches of providing technical and extension support to farmers and entrepreneurs were infused with new life and orientation.

The significant achievements and important activities of the institute during 2005-06 are briefly brought-out in this report under the heads: Research achievements, Educational Achievements, Extension Achievements, Linkages and Collaborations, Honours and Awards, Publications, etc. The efforts of all the faculty members, staff and students are noteworthy in this endeavour.

I am extremely thankful to Director General (ICAR), Deputy Director General (Fisheries) and Deputy Director General (Education) for their constant support and valuable suggestions. My sincere thanks are due to Chairman and Members of Research Advisory Committee, Quinquennial Review Team, and Members of Board of Management, Academic Council, Staff Research Council, Extension Council, Board of Examiners and other Institute Level Committees for their cooperation and support. My Special thanks are due to the Publication Team for bringing out this annual report.

My thanks and compliments are due to all the scientists, staff and students of CIFE.

CIFE, Mumbai
April 01, 2006

(Dilip Kumar)
Director

2 Executive summary

The premier alma mater for fisheries in India Central Institute of Fisheries Education was established in 1961. Since then, the institute has made significant contributions to the overall fisheries development in the country through education, research and extension activities. The progresses made by the institute during 2005-06 are briefly presented below.

A total of 30 research projects under institute funding and 15 research projects under external funding, including one each under Indo-Norwegian Programme of Institutional Cooperation and Australian Centre for International Agricultural Research were undertaken. Apart, three technology refinement projects were in operation in this period. The notable research achievements during the year were Cage culture for rearing fingerlings and table-size fish in open waters, Amelioration of the short-term deltamethrin stress using ascorbic acid in common carp, Influence of clay type and content, dissolved organic matter and calcium carbonate on toxicity of xenobiotics, Histamine-forming ability of the luminescent bacteria at low temperature, Dietary modulation to achieve high concentrations of health promoting omega-3 fatty acids in rohu, Growth, mortality and stock assessment studies on eight species of fish and three species of cephalopods off Mumbai, Seed production of Asian catfish in inland saline water, Potassium amendment for better growth of catla in inland ground-saline water, Input to the database on risk assessment on Indian seafood, etc.

The educational programmes offered by the Institute progressed satisfactorily as per schedule: 38 students obtained their M.F.Sc. degrees, 18 their Ph.D. degrees and 25 trainees completed their Post-graduate Diploma in Inland Fisheries. The admissions during the period were 45 for M.F.Sc. and 23 for Ph.D. programmes; 23 trainees were admitted to the Post-graduate Diploma in Inland Fisheries. One M.F.Sc. (FRM) student underwent a short training in Singapore as a part of Hiralal Chaudhary Endowment Scholarship for scoring the highest overall grade point in M.F.Sc. and a Ph.D. student undertook short-term research training in Denmark for being the overall topper in Ph.D. coursework through Tata Endowment Overseas Research Scholarship Scheme. One Ph.D. student was conferred with the Young Scientist Award-2005 and an M.F.Sc. student won the Best Poster Presentation Award from the Asian Fisheries Society, Indian Branch, at the 7th Indian Fisheries Forum.

Two training programmes were organized under the scheme Centre for Advanced Studies in Fishery Science on Advances in disease diagnostics for finfish and shellfish health management, and Recent advances in biochemical and molecular techniques and their applications in aquaculture. One summer school on Aquatic microbiology with reference to aquaculture was also organized. The institute organized nine conferences/seminars/ workshops/ brainstorming sessions during this period. The faculty participated in 19 training programmes/summer schools/winter schools, 45 conferences/seminars/workshops/symposia/for ums/congresses, and 10 brainstorming sessions/awareness camps/farmers' meet organized at the national and international levels. Two of the faculty members underwent training at the Institute of Aquaculture Research in Norway.

The extension achievements during this period are laudable. The institute organized 29 short-term training programmes and a special training progamme for the farmers from Bihar on Giant freshwater prawn seed production and culture. The institute was represented in 19 exhibitions organized at various places throughout the country. The faculty participated in nine television programmes and a radio talk, and rendered technical guidance and fishery advisory services to 119 farmers/fishers/ entrepreneurs as per their demand. Disease diagnosis was carried out and suitable treatment measures were suggested to six aqua-farms. Scampi culture along with carp polyculture and growth stunting of carp seed were successfully demonstrated to the Uttar Pradesh farmers. Besides, a number of field visits and field training programmes were organized to disseminate fisheries technologies. The institute coordinated 1988 visitors ranging from primary section pupils to post-graduate students and trainees. The Extension Council of the institute suggested "strengthening fisheries extension services through developing appropriate, and location-specific strategies and approaches through community participation in capture and culture fisheries" as the theme area for fisheries extension.

Dr S. D. Singh was conferred with the Fellowship of Bioved Research Society,

3 Introduction

The Central Institute of Fisheries Education (CIFE) was established on 06 June 1961 under the Government of India with the assistance of Food and Agriculture Organisation of the United Nations/United Nations Development Programme. The main aim of the institute was to impart professional training and education to the in-service personnel of the expanding fisheries development sector at that juncture. The institute came under the administrative control of the Indian Council of Agricultural Research on 01 April 1979. The Deemed to be University status was accorded to CIFE on 29 March 1989; subsequently, the scope and mandate have been widened to include education as well as research. Though the fisheries sector in India has metamorphosed from the subsistence level into a thriving industry, the vast majority of the fishing communities all along the Indian coast and in inland areas still struggle hard to make a decent living.

Initially, CIFE was housed in the Institute of Science building, Bombay, and in 1964, it was shifted to a rented building at Masjid Bunder, Bombay. However in March 1967, the Institute moved to the present independent campus at Seven Bungalows, Versova, in the western suburb of Bombay. CIFE, Mumbai, is presently housed in the lush green Seven Bungalows Campus, and the newly developed serene and expansive Yari Road Campus each a kilometre apart. The 2.3-ha Seven Bungalows Campus, which is located about half a kilometre away from the Versova beach, has a three-storey building that houses laboratories, class rooms, computer cell, committee room, auditorium, Director's chamber, library, aquarium, museum, workshop, and administrative and accounts sections together with a backyard wet-laboratory and prawn hatchery. The Campus also has hostel and dormitory facilities, guesthouse, staff quarters, gymnasium, healthcare centre and sports facilities. The recently-developed 6.7-ha Yari Road Campus has a B+G+2 Academic Building that houses state of the art laboratories, class rooms, faculty and staff chambers, chambers of the Director and Joint Director, conference hall, community hall, aquarium, examination and academic cells, etc. Apart from wet-laboratories, ponds and hatcheries, library building, staff quarters and ladies hostel are under construction. CIFE also possesses two training-cum-research vessels, *MFV Saraswati* and *MFV Narmada*, which are used for teaching and research activities.

There are eight major functional divisions at CIFE equipped with full-fledged laboratories and 17 sections/cells. Apart from

Mandate

i. To conduct Masters and Doctoral programmes in various disciplines of fisheries science and technology
ii. To establish centres of excellence in emerging areas of fisheries science
iii. To conduct refresher training programmes for fisheries developmental and extension personnel
iv. To conduct basic and inter-disciplinary research in fisheries
v. To conduct need-based capsule/vocational training on various technologies related to fisheries and allied disciplines
vi. To provide institutional support for consultancy and participation in sponsored projects and programmes with other institutions, agencies and industries

the headquarters in Mumbai, the Institute has five centres located in different aqua-climatic regions (Kolkata in West Bengal, Kakinada in Andhra Pradesh, Powarkheda in Madhya Pradesh, Lucknow in Uttar Pradesh and Rohtak in Haryana) of the country with farms and infrastructural facilities for imparting hands-on training to students, farmers and development personnel as well as to conduct need-based research projects.

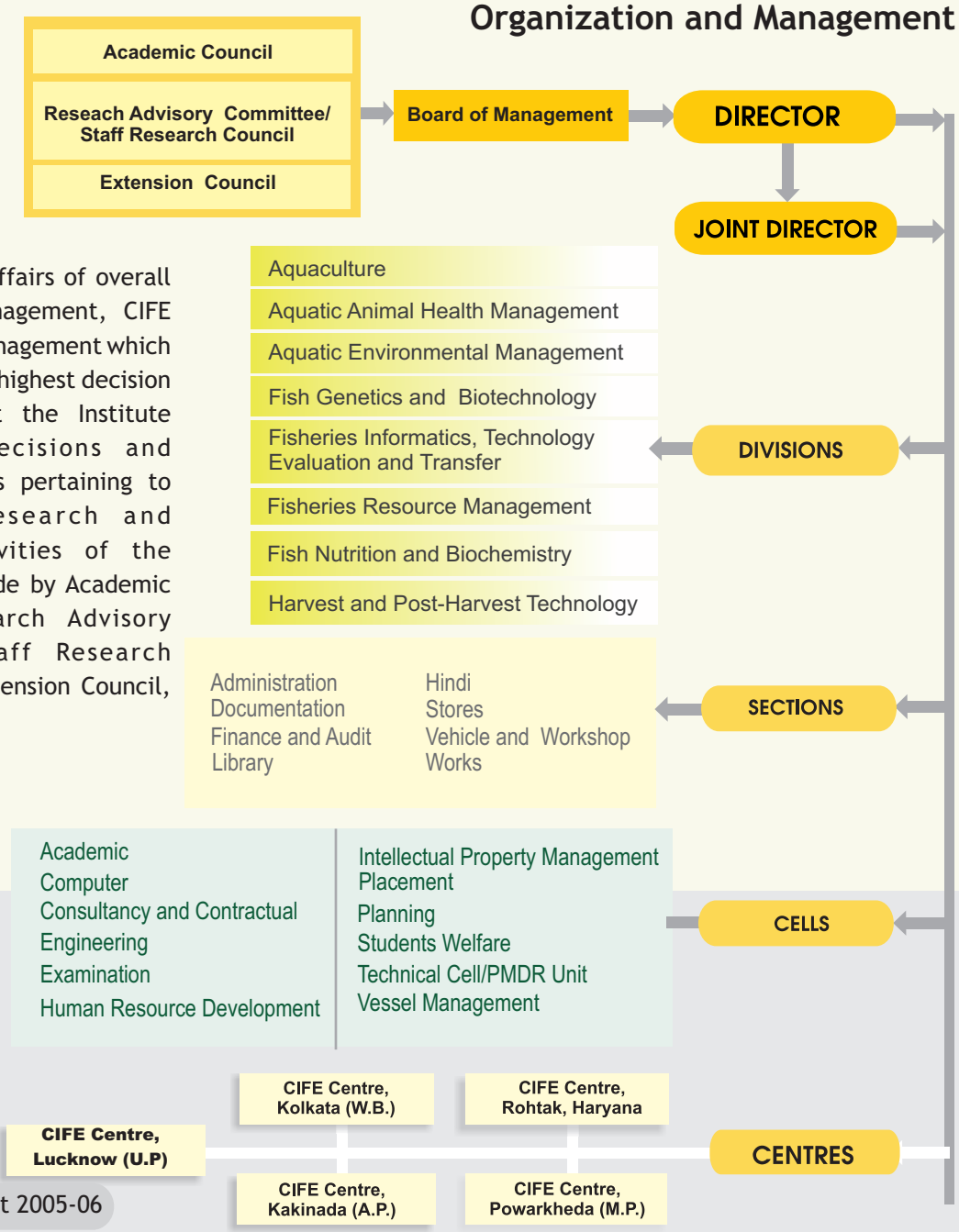
Budget

(Rs in Lakhs)

S. no.	Head	Sanctioned	Received	Expenditure incurred
1	Plan	952.73	952.73	951.39
2	Non-plan	1488.00	1488.00	1389.55
3	CAS	6.82	8.07	5.25
4	SDU	16.50	33.00	16.41
5	Externally-funded projects			
	R-Deposit	75.25	75.25	53.50
	AP Cess	49.54	49.54	20.38
6	NEH	6.00	6.00	5.96
7	Any other fund	-		-

Organization and Management

At the helm of affairs of overall Institutional Management, CIFE has a Board of Management which functions as the highest decision making body at the Institute level. The decisions and recommendations pertaining to academic, research and extension activities of the Institute are made by Academic Council, Research Advisory Committee/Staff Research Council and Extension Council, respectively.



4 Research achievements

4.1. Institutional Projects

Refinement of cage culture for rearing fingerlings and table size fish in open waters with emphasis on nutrition

Personnel: M. P. Singh Kohli, Kiran Dube-Rawat, R. K. Langer, N. P. Sahu, Chandra Prakash and A. K. Reddy

The experiment for culture of fry to fingerlings was started on 8 August 2005. Twenty cages were stocked with *Catla catla* and *Labeo rohita* fry (each species 50%) having an initial length and weight of 30-36 mm (32.47±2.03 mm), 0.225-0.350 g (0.306±0.03 g) and 29-37 mm (32.53±2.39 mm), 0.275-0.350 g (0.312±0.02 g), respectively. The stocking density was 100 numbers per cubic metre, *i.e.*, 1,800 numbers per cage. Five cages (cages 1 to 5) were kept as control and fry were fed on rice bran and oil cake (1:1). In five cages (cages 6 to 10), the fry were fed on 20% protein feed. In five cages (cages 11 to 15), fry were fed on 30% protein feed and in the remaining five cages (cages 15 to 20), fry were fed on 40% protein feed. The fry were fed at 2-5% body weight twice a day. After a culture period of 118 days, the percentages of survival were 74.88, 80.50, 90.42 and 94.03, respectively. In all, out of the 36,000 fry stocked in 20 cages, 30,585 fingerlings were harvested with an overall survival of 84.96%. The experiments were continued with the harvested fingerlings of catla and rohu (1:1) in 20 cages with the same feed pattern. The stocking density was five fingerlings per cubic metre, *i.e.*, 90 fingerlings per cage.

The physicochemical parameters during the experimental period were monitored throughout the study, and the gross primary production was 520-710 mg C/m^3/h and net primary production 250-350 mg C/m^3/d. The available plankton was recorded. The phytoplanktons were *Dictiospherium, Merismopedia, Camphylodiscus, Melosira, Ankistrodesmus, Phormidium, Pediastrum, Scenedesmus, Navicula, Closterium Cosmarium, Nitzchia, Synedra, Cyclotella, Terbellaria,* and *Zygnema,* and the zooplankters were *Ceratium, Brachionus, Keratella, Cyclops, Asplanchna, Polyarthra, Filinia, Ceriodaphnia, Cypris* and *Nauplius*.

Evaluation of permethrin and deltamethrin toxicity and efficacy of ascorbic acid in reducing toxicity-related stress in common carp

Personnel: Neelam Saharan, Kiran Dube-Rawat, Chandra Prakash and P. P. Srivastava

Physicochemical parameters of water were adversely affected as the concentration of synthetic pyrethroids, *viz.*, permethrin and deltamethrin, increased. There were slight decreases in pH (7.51 to 7.34) and dissolved oxygen (7.05 to 6.74 mg/l), and increases in total alkalinity (53 to 58 mg/l), hardness (55 to 58 mg/l) and free CO_2 (1.11 to 1.69 mg/l).

The adverse impact was greater in the case of deltamethrin-treated fishes. The glycogen content of liver showed a gradual decrease with increase in exposure time. The reduction in hepatic glycogen was significant in the initial 12 hours of exposure in comparison with the control, followed by a slight recovery and thereafter, a gradual fall up to 96 hours. The glucose level in blood increased concomitantly with the increase in exposure time of permethrin and deltamethrin. The glucose level was higher in deltamethrin-treated fish than in permethrin-treated fish.

An experiment was conducted to determine the effective dose of ascorbic acid to ameliorate the short-term deltamethrin stress in common carp. A single sub-lethal concentration of 17.67 µg/l (1/3rd of 96 h LC_{50}) was selected for the chronic exposure in all 18 experimental tanks which were divided into six treatments containing three tanks each as triplicates. First three tanks were control (T_0 diet), where neither pesticide nor ascorbic acid-supplemented feeds were used but were fed only with normal diet. In the second treatment (T_1), only 1/3rd of the pesticide was used with no supplementation of

feed with ascorbic acid. In the other four treatments (T_2, T_3, T_4 and T_5), 1/3rd of the pesticide was used along with feed supplemented with different doses (500, 1000, 1500 and 2000 mg/kg) of ascorbic acid in diet. Six different practical diets were prepared for chronic studies with different doses of ascorbic acid. Except ascorbic acid, in all the feeds, the same composition of other feed ingredients such as fish meal (10.0%), soybean meal (25.0%), rice polish (12.5%), wheat bran (22.0%), vegetable oil (5.0%) and maize powder (25.0%) was used. Growth of fish, and the ascorbic acid content in muscle, liver and kidney were measured every 15th day. The histopathological studies of gill, liver, intestine and kidney were carried out.

Data pertaining to the effect of sub-lethal exposure of deltamethrin on average body weight of *Cyprinus carpio* fed with different diets for a period of 45 days were ananysed. There was a significant effect of diet on the average body weight of fish. Control fish (T_0) growth was 12.1%, and almost similar growth was observed in T_4 and T_5 followed by T_3. Negative growth (- 4.3%) from the initial weight was recorded in T_1. To, T_5 and T_6 showed significant increase in the average body weight in 45 days whereas in T_1, there was decrease in weight and in T_2, there was marginal growth.

The effect of sub-lethal exposure of deltamethrin on the changes in ascorbic acid content of liver, kidney and muscle of common carp at the end of 45 days was studied. Significant reduction in ascorbic acid content in different organs was observed upon deltamethrin exposure when fish were fed with different test diets. Ascorbic acid content in liver tissue showed a 46.8% reduction from the control in T_1, 36.7% in T_2, 33.0% in T_3, 23.6% in T_4 and 16.1% in T_5 feeds. Kidney and muscle also showed similar trends as in liver and the percentage reduction in kidney was 44.7, 39.8, 30.3, 26.5 and 3.51, respectively, and in muscle, it was 70.3, 40.6, 32.6, 23.1 and 12.5, respectively. Vitamin C contents in kidney and muscle of T_5 and T_6 groups were almost similar to that of the control.

Gill of common carp when fed with normal diet showed equally-spaced secondary gill lamellae and intact cellular layer. Gill of common carp fed with normal diet containing only pesticide (T_1 diet) showed enlargement of cartilaginous cells and clubbing of gill lamellae. T_2 diet showed the dwarfing of the primary gill filaments and mild atrophic changes in the gill filament. T_3, T_4 and T_5 showed reduction in cartilaginous cell enlargement and secondary gill lamellae improvement. In T_6 diet, gill filaments were almost similar to those of normal tissue as observed with the normal diet.

Liver of common carp when fed with normal diet (T_0) showed normal hepatic cells with marked and prominent nuclei. Liver of common carp fed with normal diet along with pesticide (T_1 diet) showed prominent vacuolation and broken boundary walls. T_2 diet showed enlarged vacuoles but cellular structure was improving. T_3 diet showed reduced vacuolation and restoration of cell structure. T_4 and T_5 showed normalized cellular structure.

Normal histological structure of intestine of common carp was observed when fed with the normal diet T_0. The effect of normal diet with pesticide showed detachment of villi from basement and more space between villi. T_2 diet showed prominent appearance of goblet cells. T_3, T_4 and T_5 showed the normal appearance of villi.

T_1 diet showed degenerative as well as necrotic changes in the tubular epithelium. Shrinkage of capillary tuft was observed in T_2 treatment. In T_3 treatment, vascularization improved, and in T_4 treatment, well marked improvement of vascularization was observed and the capillary tuft was normal. T_5 treatment showed full vascularized glomerulus and capillaries.

Refinement of freshwater pearl culture technology for developing designer pearls

Personnel: Kiran Dube-Rawat, R. K. Langer,

Chandra Prakash and Bharti Ghagre

Various dice have been procured. Some animals have also been procured. Some shapes are ready for implantation. Trial implantations are to be done with the new shapes.

Induced breeding, hatchery development and seed rearing of *Clarias batrachus* and *Ompok pabda*

Personnel: V. K. Tiwari, Suryakant Patil; Chandra Prakash and C.S. Chaturvedi

Efforts were made to collect *C. batrachus,* but most of the time, mortality occurred on the way as well as after reaching. Even then, few specimens of could be procured. A total of 15 sets of *O. pabda* were undertaken on a trial basis for the breeding experiment in one of the private farms at Malda in West Bengal. The fish were bred successfully. The fry of *C. batrachus* and *O. pabda* are being procured from Malda and are in rearing process in one of the cement tanks at CIFE for further experiments. Efforts are on to procure some more fish from other places. One private farm in Durg District of Chattishgarh has been identified for the breeding and rearing of seed of the above species.

Development of nitrogenous bacterial fertilizers for aquaculture

Personnel: P. K. Pandey and Asha T. Landge

Brackishwater earthen fish ponds, each measuring 0.08 hectare, were stocked at the rate of 2500 no./ha with fingerlings of milk fish (*Chanos chanos*) weighing 3.0 g on an average. Each pond was fertilized fortnightly with sawdust at the rate of 3.0 g/m^2 consisting of the inoculum of *Azotobacter* spp. The experiment was conducted for 170 days. During the period, the physicochemical parameters of pond water, plankton population, sediment characteristics and fish biomass were studied. Pond water showed significantly high levels of NO_3-N and PO_4-P compared to the control. The sediment showed high levels of available phosphorus indicating the role of the phosphate-solubilizing strain of *Azotobacter* spp. Low level of dissolved oxygen and high level of CO_2 were recorded in the treated fish ponds. Among the biological parameters, plankton analysis showed high population with the dominance of phytoplankton, and the biomass and specific growth rate of fish were also significantly high in treated fish ponds in comparison to control.

Microcystin-LR and anacystin in Powai Lake and their impact on the zooplankton and ichthyofauna

Personnel: A. Vennila, K. Venkateshvaran and Asha T. Landge

Samples were collected from the lake and analysed for microcystin. The toxin contents ranged from 142 to 380 µg/l, 1040 to 1402 µg/g and 006 to 3850 µg/g, respectively, for water, plankton and fish liver. Common carp liver showed vascular dystrophy, perivascular focal necrosis, pycnotic nuclei, karyolysis, shrinkage of hepatocytes, sinusoidal architecture breakdown and blood pooling.

Chromium-resistant bacteria as potential bioremediators in aquatic environments

Personnel: P. K. Pandey, C. S. Purushothaman, A. Vennila, Asha T. Landge and A. K. Padmanabhan

Water samples were collected from contaminated sites in Kanpur, Agra and Delhi. Concentrations of chromium measured using atomic absorption spectrophotometer ranged from 0.003 to 0.055 mg/l. The bacteria in the samples were enumerated on nutrient agar by pour-plate technique. Fifteen colonies of bacteria were isolated from the nutrient agar medium and maintained in separate slants. The growth patterns of all the 15 isolates were evaluated on nutrient agar media with different

concentrations of chromium. Three isolates were identified as belonging to the genera *Enterobacter, Escherichia* and *Salmonella*. The chromium-reducing ability of these isolates will be evaluated in the coming year.

Histamine forming ability of the luminescent bacteria at low temperature

Personnel: B. B. Nayak, S. Basu and M. K. Chouksey

Eighty-six confirmed luminescent bacterial isolates have been obtained and identified to species level. They have been screened for histamine-forming ability at chilled condition. While only one isolate of *Photobacterium* sp. and several of *Vibrio harveyi* were found to be histamine formers at low temperature, the histamine formed by them was not significant enough to call this organism potential for histamine poisoning. Ice-storage studies were done and the luminescent bacteria isolated were much slower compared to other histamine formers originating from land-based contamination. The luminescent bacteria including the *Photobacterium* group member, though known to be low-temperature histamine former were not found to be prolific histamine formers. Therefore, restricting land-based contaminants and maintaining low temperature would be sufficient to contain the histamine problem in mackerel.

Optimal designs, and economic viability of fishing craft and gear along the coast of Maharashtra

Personnel: Latha Shenoy, S. K. Pandey, Satish S. Kamat and Avinash N. Sable

Five coastal districts, Thane, Greater Mumbai, Raigad, Ratnagiri and Sindhudurg, were selected for the study. Three districts, Thane, Greater Mumbai and Ratnagiri, were covered during the year. Data regarding principal dimensions of boat, engine details, and other information about tonnage, area and depth of operation, fish-hold capacity, quantity of ice carried per trip, the type of fishing gear operated, etc. were collected. Design details such as type of material, mesh size, dimensions of the net, accessories used like head rope, foot rope, floats, sinkers, warps, etc. of the fishing gear operated and details of the fishing operations were collected. Data on economics of fishing operations were also collected.

Fisherwomen and livelihoods- An ergonomics perspective

Personnel: Arpita Sharma, S. N. Ojha, P. S. Ananthan, A. D. Ragabhagat, G. K. Rao, D. Khogre, D. L. Sawant and Rajni H. Khandagale

It was found from the study that women's work in fisheries sector is not just limited to the post-harvest sector and women have a fair share in the decision on expenditure-related matters. Work study of fisherwomen has revealed that work of fish drying and marketing are moderately heavy activities. Statistical tests (ANOVA) showed that there is a significant difference between the activities. Nature of work as well as the environmental conditions seems to be responsible for this. As these activities are showing variations, rest breaks can be designed. Environmental study showed that 'radiant temperature' and 'humidity' were high as they work in the open under direct sun. To evaluate the nutritional and health status of fisherwomen, nutrient contents of food taken by fisherwomen were chemically analysed and compared with the recommended dietary allowances by the Indian Council of Medical Research. Results of chemical analysis of food revealed that nutrients namely iron, calcium and protein are not according to the recommended dietary allowances.

Barriers to international trade in fish products: A critical evaluation of trade under WTO

Personnel: P. S. Ananthan, R. S. Biradar and Arpita Sharma

The review revealed that reduction of

import duties for seafood products in major markets contributed significantly to the recent growth in international trade. However, non-tariff barriers in the form of quality and safety standards, technical regulations, anti-dumping provisions and subsidies have gained in scope and importance as effective instruments to restrict imports and protect the respective domestic industry. A case study on the impact of US shrimp anti-dumping duty has shown that the export volume from all six countries (India, Thailand, Vietnam, China, Brazil and Ecuador) have declined between eight and 30%, while Indonesia and Bangladesh (not targeted) have improved theirs by as much as 70 and 110%, respectively since Dec 2003. On the other hand, the unit values in US market did not appreciate to the benefit of domestic fishers as was the expectation and rationale for the anti-dumping duty. India has lost exports to the tune of Rs. 216 crores between Jan-Aug 2005. This has also brought down the farm-gate prices by 15-20% in India and has cost SEAI $1.5 million in legal battle..

Another case study on the barriers to fish exports to Spain showed that Spain heavily subsidises its fishing industry (€ 350/t of live weight-equivalent of fish caught) accounting for 42% of total EU subsidies. A less visible but more distorting measure is Spain's third-party fishing agreements with Argentina, Cape Verde, Mauritania, Mozambique, Namibia and Senegal (for tuna, shrimp, cephalopods and small pelagics) wherein Spanish vessels get rights to fish in these countries' EEZ waters in return for a sum and preferential import access. The total catches under this agreement amount up to 60% of fisheries resources in certain waters. This measure puts counties like India in a disadvantageous position, as it needs to pay a higher duty and meet stringent standards.

Geographical information system for sustainable brackishwater aquaculture development in Maharashtra and Gujarat

Personnel: R. S. Biradar, Neelam Saharan, A. K. Reddy, Ram Singh, Madhavi Pikle, S. S. Gajbhiye, Rajani H. Khandagale and N. Agalawe

Aliabet in Vagra Taluk of Bharuch District of Gujarat was selected as the study area. Aliabet is about 35 km west of Bharuch, adjoining the mouth of the River Narmada and saline water can be drawn from the Narmada estuary. Geo-registered LISSIV IRSP-6 (Resource Sat 1) satellite image was used for the study. Forty soil samples from 20 locations and six water samples were collected. Soil samples were collected at two depths, *viz.,* 5 and 15 cm below the surface. Handheld Garmin GPS 12xL was used to mark the sampling stations. The soil samples collected from the study area were analysed for 10 soil quality parameters. The soil quality parameters recorded were pH, water retention capacity, soil texture, clay percentage, sand and silt percentages, total nitrogen, phosphorus, organic matter and organic carbon percentage. The values of all these parameters were within the ideal range required for brackishwater aquaculture. Therefore, the soil quality parameters in the study area are not limitations for carrying out brackishwater aquaculture. Water quality parameters collected from the six sampling stations in the study area were also analysed for 15 water quality parameters. The water quality parameters recorded were temperature (air and water), pH, dissolved oxygen, salinity, alkalinity, CO_2, NH_4-N, NO_2-N, NO_3-N, PO_4-P, chloride, hardness, total organic matter and biochemical oxygen demand. The water quality parameters recorded were within the recommended values for brackishwater aquaculture. The data suggest that water quality in the study area is suitable for carrying out brackishwater aquaculture and is not a limitation. Attribute table of soil and water quality parameters for each of these sampling stations was created. Thematic layers were created for different water and soil quality parameters. These layers were added by assigning different weights to prepare the composite layer for soil and water. The raster analysis was done to perform buffering, overlaying and regrouping.

A pilot study on supply-chain management in fisheries

Personnel: S. N. Ojha, A. D. Ragabhagat and G. K. Rao

The project was taken up in the area of Greater Mumbai; 47 retailing shops under the Brihan Mumbai Municipal Corporation that are selling fish were randomly selected for the study, and were classified as large, medium and small markets. Ninety-seven respondents were randomly interviewed with the help of a structured questionnaire. Procurement frequency, transportation facilities preferred, storage facilities availed and the retailers' perception about consumers' response were studied. It was observed that there was an urgent need to improve the supply-chain management strategy in favour of the fisher-retailers so that money starts flowing into their community to meet their bare minimum requirements of life in the commercial hubs in the coastal belts. It was also felt that neglecting the fisher-retailers' problems and interests in the consumers' studies and consumer awareness programmes may allure other commercial enterprises. This may further marginalize the traditional fishers from retailing.

The factors that demand immediate attention in the supply-chain management and efficient consumer response of fish are, modernization of procurement of the fish from wholesalers and landing centres, improving the marketing infrastructure for better hygiene, storage, and assured and cheap supply of water and ice.

Demonstration on crab fattening and collection of sea bass seed were provided. Buyback arrangements are being worked out under the project.

Estimation of intra-specific variation among the hatchery-bred rohu population of three States

Personnel: S. Jahageerdar and S. Bhandkar

Samples from Dapchery, Khopoli, Bhadra, Tung-Bhadra, Pipodra and Valsad hatcheries were collected. A 9-point truss network was developed and the information collected on these points along with other routine morphometric mesurements. Truss analysis was carried out with PCA, cluster and discriminant analyses employed to determine the significant differences between the populations. The truss analysis revealed that there was significant variation between different stocks and the stocks were completely different from other stocks.

Sperm preservation of Asian catfish *Clarias batrachus*

Personnel: Gopal Krishna

During the period reported, the milt was evaluated, and the chemical and biochemical compositions of the milt were analyzed. The milt was further extended in the artificially prepared extender with cryoprotectant. The milt was then cryopreserved under liquid nitrogen using horizontal freezing technique. The cryopreserved milt was further analyzed for its quality after definite time intervals. The milt was evaluated for scanning and transmission electron microscopic studies. The preserved milt is stored for short-term fertility trials.

Molecular studies on promoters and growth enhancers of commercially important fishes

Personnel: S. D. Singh, P. P. Srivastava and J. P. Patil

Growth hormone and Beta-actin gene promoter from Asian seabass genome have been amplified using thermal cycler and specifically designed primers, and analyzed and confirmed by agarose gel electrophoresis for their size as 1.3 and 2.3 kb, respectively.

Growth Hormone gene (1.3 kb) and Beta-

actin gene promoter (2.3 kb) of Asian seabass after PCR and purification were cloned for the production of recombinant plasmids 4.186 and 5.186 kb using PTZ 57 R/T as cloning vector and *Escherichia coli* DH5 as host cells. The transformation and cloning efficiency of the above genes was also checked using an electroporator. Growth hormone and Beta-actin gene promoter containing recombinant plasmids selected as white clones from X-gal-IPTG-ampicillin petri plates were further confirmed by plasmid isolation, polymerase chain reaction and gel electrophoresis.

Double-digestion of the recombinant plasmids (4.186 and 5.186 kb) isolated from positive clones was completed successfully with restriction endonuclease, Hind III and Xba to release the growth hormone gene insert of about 1300 bp and with BamH I and Xba I to release the Beta-actin gene promoter insert of about 2300 bp, respectively. These recombinant clones containing growth hormone and Beta-actin gene promoter are cryopreserved at **-20**°C for further use in gene sequencing and transgenic work.

Studies on nutrient-dense micro-particulate diet for hatchery rearing of *Macrobrachium rosenbergii*

Personnel: A. K. Pal, G. Venkateshwarlu, N. P. Sahu and A. K. Reddy

Protein hydrolysates were prepared from the low-cost fish either by temperature treatment at 55°C for two hours, papain at 0.5% or by adding formic acid at 5% of the total biomass. Out of the three methods tried, heat treatment was found to be cheaper and effective in the preparation of protein hydrolysate. Besides these, carboxymethyl cellulose and sodium alginate were evaluated as binders in the microparticulate diet. It was found that sodium alginate at 1.5% was more effective for enhancing the stability of feed in water. After evaluation of the ingredients, trial diet will be prepared for feeding.

Studies on the production potential and conversion efficiency of Omega-3 fatty acids in Indian major carps

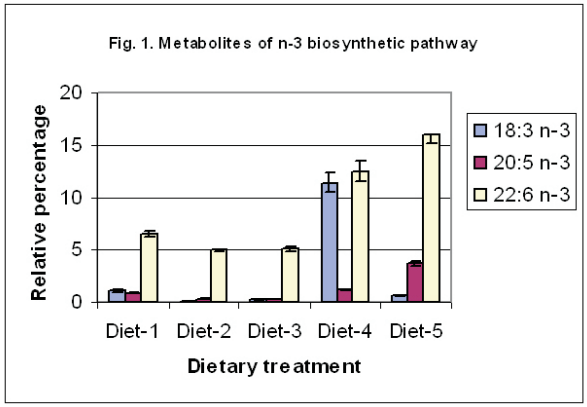
Personnel: G. Venkateshwarlu, S. D. Singh and A. K. Pal

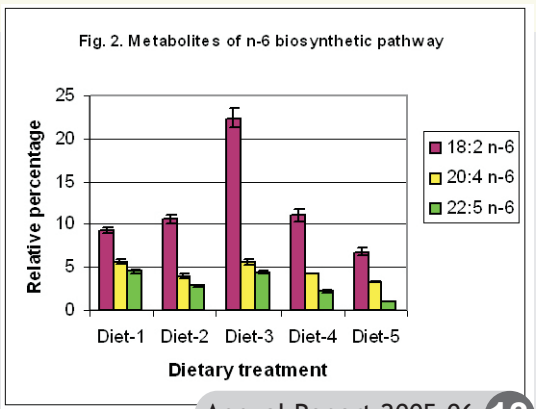
Dietary fatty acid strategies of metabolic relevance were studied in rohu fingerlings with an aim to ascertain the biosynthetic pathways responsible for converting essential fatty acids (linoleic and linolenic acids) into human health beneficial highly unsaturated fatty acids (HUFA) such as eicosapentaenoic acid (EPA, 20:5, n-3), docosahexaenoic acid (DHA, 22:6, n-3) and arachidonic acid (AA, 20:4, n-6).

A feeding experiment of rohu fed with five experimental diets with varying levels of different classes of fatty acids (Diet-1 rich in 70.8% saturated fatty acids, Diet-2 rich in 73.8% mono-unsaturated fatty acids, Diet-3 rich in 54.6% linoleic acid, n-6, Diet-4 rich in 48.6% linolenic acid, n-3 and Diet-5 rich in 21.76% HUFA) for 90 days has been carried out. The fatty acid profiles of fish muscle and liver were studied by gas chromatography (GC) and GC-mass spectrometry. A total of 34 fatty acids were identified in the muscle and liver of rohu. Dietary-modulated biosynthetic capabilities of n-3 (Fig. 1) and n-6 (Fig. 2) pathways were established by the identification of their metabolites in the rohu fed diets supplied with substrates. The liver fatty acid composition of the fish fed with different diets revealed the activity of desaturases and elongases with respect to n-6 and n-3 biosynthetic pathways.

Significant amounts of metabolites of n-6 pathway (18:3, 20:3, 20:4 and 22:5) and n-3 pathway (18:4, 20:4, 20:5, 22:5, 24:5, 24:6 and 22:6) were found in the muscle and liver of rohu fed with Diet-3 and Diet-4, respectively. Nutritional modulation of these pathways in rohu was evident from the levels of AA, EPA and DHA, which were directly proportional to their precursors.

It has been observed that the rohu can regulate the fate of fatty acids assimilated from





diet and also produce endogenously. The results also suggest that rohu can discriminate between dietary fatty acids employing them for selective deposition or energy production by oxidation. It can be concluded from the present study that high concentrations of health promoting EPA, DHA and AA can be achieved in rohu by dietary modulation.

Prevalence of aflatoxin in feed ingredients, remedial measures, and its effects on growth performances and metabolic responses in Indian major carp, *Labeo rohita* (L.)

Personnel: N. P. Sahu, P. P. Srivastava, K. K. Jain and K. Thilagavathy

Aspergillus flavus produced maximum aflatoxin in gram hulls (527.50 ppb: J: 17.50), followed by wheat bran (405.00 ppb: J: 15.00) and coconut cake (195 .00 ppb: J: 15.00). A. parasiticus produced maximum aflatoxin in wheat bran (350.50 ppb: J: I0.50) followed by gram hulls and maize (250.50 ppb: J: 10.50). Control group also showed maximum aflatoxin in wheat bran (57.00 ppb: J: 6.00), soybean meal (57.50±6.50 ppb), gram hulls (41.50±3.50 ppb) and coconut cake (31.00±4.00 ppb). It was observed that clove oil followed by sodium propionate was effective in controlling the mould growth in feed ingredients.

Collected various feed ingredient samples from different places and analysed in the laboratory. Aflatoxin percentage was calculated and results obtained in different conditions are being analysed to see their effect in the feed formulation for fish.

Studies on stock assessment of some of the fishery resources off Maharashtra coast

Personnel: S. K. Chakraborty, R. S. Biradar, A. K. Jaiswar and R. Palaniswamy

Under this project, growth, mortality and stock assessment studies have been conducted on eight species of fish and three species of cephalopods from Mumbai. The species are listed family-wise.

Family Sciaenidae: *Johnius macrorhynus, Johnieops vogleri, Otolithes cuvieri* and *Johnieops sina*

Family Nemipteridae: *Nemipterus japonicus* and *N. mesoprion*

Family Serranidae: *Ephinephelus diacanthus*

Family Priacanthidae: *Priacanthus hamrur*

Family Loliginidae: *Loligo duvauceli*

Family Sepiidae: *Sepia aculeate* and *Sepiella innermis*

The length frequency data have been collected on a regular basis from the landing centres of Mumbai. The data thus collected were raised for the day and subsequently, for the month. Employing ELEFAN of FiSAT programmes, the data were subjected to analysis of different parameters like growth, mortality and population parameters.

The details of species-wise length range, number of specimens measured and the estimated total catch are presented in Table 1 whereas Table 2 gives the details of mortality and stock parameters. Only *S. innermis* shows sexual dimorphism. Thus, males and females were

Table 1. Annual size range, number of specimen measured and total catch (January-December 2005)

S. no.	Species	Length range (mm)	Specimens measured (no.)	Total catch (t)
1	*J. macrorhynus*	90 - 299	2509	739.500
2	*J. vogleri*	120 - 339	2584	880.167
3	*O. cuvieri*	90 - 369	2710	825.650
4	*J. sina*	90 - 259	2648	331.450
5	*N. mesoprion*	30 - 309	3151	810.617
6	*N. japonicus*	60- 329	3390	690.125
7	*P. hamrur*	110 - 379	1658	299.392
8	*E. diacanthus*	90 - 499	2445	545.225
9	*L. duvauceli*	20 - 369	3447	590.867
10	*S. aculeata*	20 - 179	2575	600.317
11	*S. inermis* - Male	25 - 94	1779	202.746
12	*S. inermis* - Female	25 - 94	2035	220.745
	Total		30931	6736.801

Table 2. Mortality, population and stock parameters of all the species

Species	Z	M	F	E	U	Y	Y/U Total stock	Y/F Standing stock	MSY
J. macrorhynus	5.36	1.46	3.90	0.73	0.72	739	1026	187	501
J. vogleri	3.24	2.42	1.82	0.56	0.54	880	1630	483	782
O. cuvieri	2.45	1.26	1.19	0.48	0.44	826	1877	694	850
J. sina	4.90	2.02	2.88	0.58	0.57	331	581	202	495
N. japonicus	4.12	1.48	2.64	0.64	0.63	690	1095	261	538
N. mesoprion	4.95	1.68	2.77	0.62	0.61	811	1329	293	652
P. hamrur	2.81	1.58	1.23	0.43	0.40	294	747	243	341
E. diacanthus	2.26	1.11	1.15	0.51	0.45	545	1211	474	475
L. duvauceli	3.58	1.82	1.76	0.49	0.47	591	1257	336	601
S. aculeata	11.62	2.10	9.52	0.82	0.82	600	732	63	366
S. innermis - Male	9.32	4.07	5.25	0.56	0.56	203	362	39	182
S. innermis - Female	12.62	4.05	8.57	0.68	0.67	221	315	25	164

separately measured at the landing centre.

'Z' is calculated by Pauly as length converted catch curve.

'M' by Pauly's empirical formula except the cephalopods where M is estimated by Cushing.

$E = F/Z$

$U = F/Z*(1-e^{-Z})$

$MSY = 0.5*Z*B$

The exploitation rates of *J. macrorhynus*, *N. japonicus*, *N. mesoprion*, *S. aculeata* and *S. innermis* (female) were higher as compared to the same period last year.

Mapping of marine algal biodiversity along Maharashtra coast

Personnel: Geetanjali Deshmukhe, R. S. Biradar, A. Dwivdi and Madhavi Pikle

Clonal cultures of the micro-algal species, *Chlorella, Pediastrum, Scenedesmus* and *Dunaliella,* and other phytoplankton species used for aqua-hatchery purpose are being established.

Studies on the influence of different water, soil and organic matter parameters on chemo-toxicological effects of xenobiotics to fish

Personnel: S. Datta, R. C. Das, K. Chandra, A. K. Pal and P. K. Patra

The effect of clay content and dissolved organic matter content on the toxicity of inorganic (metals) and organic (pyrethroids) xenobiotics was studied. When synthetic dissolved organic carbon (DOC) was included with the water medium at different concentrations, *i.e.*, 0.42, 0.84 and 1.68 mg/l, which were equivalent to 8, 16 and 32 mg/l natural DOC, toxicity was found to decrease. DOC formed complexes with metal ions (Pb, Cd and Hg) and reduced the metal bioavailability to fish. Both clay type and content influenced the acute toxicity of test chemicals to common carp. Values of LC_{50} were almost 1.5-2.5 times in bentonite treatments when compared with similar treatments with kaolinite. Short-term chronic

toxicity showed slightly different trend. Due to higher cation exchange capacity (higher charge on the surface), higher affinity for cations, and higher interlayer space, bentonite was able to adsorb more metal ions rendering it unavailable for fish and thereby, producing higher effect in reducing the toxicity of Pb, Cd and Hg. However, due to its hydrophobic nature, cypermethrin, though not a cation, might be absorbed on dissolved organic carbon and on the soil surface. The sorbed or bound xenobiotic in sediments was not showing its toxic effect to fish.

The results of the biochemical studies showed that predetermined sublethal concentrations (less than LC_{50} values) of xenobiotics decreased the liver glycogen reserves and total serum total protein level, whereas serum glucose, alkaline phosphatase and lactate dehydrogenase levels of advanced fingerlings and adults of scale-carp increased significantly in comparison to control group (only water) after 14 days of exposure. When calcium carbonate (125 ppm), dissolved organic carbon (0.88 mg/l) and bentonite (0.8 g/l) were included with the test chemicals, values of all the above biochemical parameters attained the levels, which were not significantly different from the control level in all cases. This was mainly due to the influence of $CaCO_3$, DOC and bentonite in reducing the chronic toxic effect of test chemicals on scale-carp.

EIA studies of West Bengal rivers to identify strategies for the enhancement of fish production in rivers

Personnel: K. Chandra, Archana Sinha, S. Datta, P. S. Pandey and A. K. Mondal

Haldia is a newly developing industrial township situated at the junction of two rivers Hooghly and Haldi. The River Hooghly carries industrial and anthropogenic wastes from the cities of Kolkata and Howrah other than the headwater constituents. The River Haldi is relatively free from anthropogenic pollutants. The established industries at Haldia include Haldia Petrochemicals, Periphthalic Acid Project of Mitsubishi Chemical Corporation, Haldia Dock Complex under Calcutta Port Trust, Exide Industries Ltd producing automotive batteries, Consolidated Fibres and Chemicals Ltd, Him Containers Ltd, Hindustan Lever Ltd, Indian Oil Corporation, Petroleum Coke Chemicals Ltd and Shaw Wallac & Co. In addition, it has 118 small-scale and cottage industries that discharge effluents into the River Hooghly.

The EIA studies were undertaken from the reference zone at Farrakka on the River Ganga. The hydro-biological samples were collected from the reference zone.

Improvement in breeding of selected oviparous ornamental fishes through feed manipulation

Personnel: Archana Sinha, P. Sardar and A. K. Mondal

The test feeds were prepared by incorporating the spore-forming *Bacillus* strain suspensions at graded levels of 0, 10^6,10^7 and 10^8 cells per g in a basal feed containing soybean oil cake, fishmeal and wheat flour. The probiotic cell suspensions were added in the control diet after the dough has been autoclaved and subsequently cooled, before pelletizing. Goldfish (average weight 11.32±1.64 g), angel (average weight 2.32±0.13 g), tiger barb (average weight 2.26±0.21 g) and pearl gourami (average weight 4.95±0.67 g) were fed with the test diets during the experimental duration in the Aquarium Laboratory of CIFE, Kolkata Centre.

The growth performance was evaluated by measuring the weight and length after a period of 30 days. At the end of the experiment, the fishes fed with the diet containing probiotic cells at 10^7 cells per g showed maximum weight gain in goldfish followed by tiger barb. The bacterial count (Table 3) in fish gut and

Table 3. Microbiology of gut of experimental fishes after feeding trial of 90 days

Parameter	Tiger barb	Angel	Gourami	Goldfish
Total heterotrophic count (per g)	$7.85x10^7$	$3.95x10^7$	$1.08x10^8$	$2.78x10^7$
Motile aeromonads count (per g)	$3.68x10^5$	$9.95x10^4$	$1.05x10^5$	$9.95x10^4$
Presumptive *Pseudomonas* count (per g)	$6.36x10^3$	$5.84x10^3$	$7.98x10^3$	$3.69x10^3$
Total coliform count (per g)	$9.20x10^2$	$1.10x10^2$	$7.96x10^2$	$1.1x10^2$

Table 4. Proximate composition of experimental fishes after 90 days experimental feeding

Fish	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Carbohydrates (%)
Angel	79.077	2.014	40.625	17.368	4.605
Gourami	80.621	2.019	40.000	15.467	5.000
Goldfish	79.792	2.328	39.388	17.391	4.469
Tiger barb	76.822	1.959	40.384	16.25	4.487

biochemical analysis (Table 4) of fish were carried out.

Histological studies of gonad were also done. Ovary and testes were fixed in Bouin's fluid containing saturated picric acid, formaldehyde and glacial acetic acid for 2-5 days. In order to facilitate the fixative penetration, the ovary and testes were cut into small pieces before fixing. Tissues were transferred to 70% ethanol and given 3-4 washes by changing the fluid after keeping for 30 minutes in each. Tissues were stored in 70% ethanol for 24 hours and then processed for paraffin embedding after passing through degraded levels of alcohol and xylene. Paraffin tissue blocks were prepared using fresh molten paraffin and metal "L" blocks, and stored in the refrigerator to avoid brittling of the wax. Desired blocks are being selected for sectioning.

The analysis of fish flesh for carotein content is being done. The second trial is going on for pearl gourami as per the protocol used for angel fish.

Strategic approach for the development of compounded feed for carp and prawn based polyculture system

Personnel: P. Sardar, R. C. Das, Archana Sinha and S. Datta

Feed formulation and manufacturing have been achieved. Three types of pelletised feeds with 0.5-2.0 mm particle size having 15, 20 and 25% protein, respectively, have been manufactured at the cost of Rs 15.13, 15.44 and 20.04, respectively. All the feeds were 25 or 0% sinking, *i.e.*, 75 or 100% floating with the sinking rate of 5 to 10 cm/min. All kinds of pellets were sufficiently water stable, *i.e.*, for more than five hours. A kind of slow sinking pellets (25% crude protein) with a sinking rate of 5-10 cm/min and water stability of more than five hours was manufactured.

Growth trial in carp and prawn polyculture system in three replicate ponds at Nepalgaunj, 24 Parganas (South), is in progress. During this trial, performance data were collected and sampling was done for laboratory analysis. A comparative study on the performance of carps and prawn under polyculture system using slow-sinking and rapid-sinking pellets with the same protein content is in progress. Growth trial with other two kinds of pellets, *i.e.*, pellets with 20 and 15% crude protein has been initiated. Final data are yet to be analysed.

Breeding and mass-scale seed raising in three non-conventional fish species in the field condition

Personnel: R. C. Das, S. Datta, P. Sardar, A. K. Mandal and P. K. Patra

The details of the brood fish stocked during the year 2004-05 are given in Table 5.

Table 5. Details of the brood fish stocked

Species	Female (no.)	Male (no.)	Average wt. of female (kg)	Average wt. of male (kg)
Notopterus chitala	42	88	3.20	2.80
Ompok pabda	250	520	0.09	0.06
Labeo bata	150	310	0.45	0.40

The fishes were fed with a formulated diet containing 30% protein consisting of rice bran, groundnut oil cake, and fishmeal supplemented with vitamins and minerals at 5% of the body weight twice daily. Water quality was monitored from time to time and necessary corrective measures were taken.

Due to late monsoon, the breeding of the above three species were undertaken in late July and continued up to the end of August 2005 using Ovaprim/Ovatide. The results obtained were very good except for *O. pabda* in which 80-90% hatching was observed, but during rearing, heavy mortality occurred and the survival rate was below 5%. Later, the breeding of *O. pabda* was undertaken after construction of a catfish hatchery with continuous aeration and water supply during late August 2005. This time, the hatchling survival rate improved and was up to 50%, and it was 30% up to the fry stage. But, in *N. chitala,* breeding was successful with hatching rate up to 95% and the survival rate of hatchlings up to 15 days was recorded to be 80%, and up to the fry stage (30 days), it was 73% and was encouraging. All the breeding and hatching operations were carried out in a specialized system using earthen circular rings of width 45 cm piling one above another inside the water. The entire breeding process was undertaken in captivity by enclosing the water area by a nylon net supported by bamboo poles. For *L. bata*, breeding was undertaken adopting the stripping method and 90% fertilization was obtained. The hatching success was up to 85% and survival of hatchlings up to 15 days was 80%; up to the fry stage (30 days), it was 75%. The details of breeding are given in Table 6.

Hatching was undertaken in hatching *hapa* and rearing of hatchlings to the fry stage in nursery ponds for *L. bata*. For *O. pabda,* it was done in the catfish hatchery and in large earthen pots, respectively, with continuous aeration and change of water, and feeding with zooplankton.

Table 6. Details of the breeding of *O. pabda, N. chitala* and *L. bata*

Species	Pairs bred (no.)	Fertilization (%)	Hatching (%)	Hatching survival (%)	Survival rate up to fry stage (%)	Fry stocked for rearing (no.)
N. chitala	38	99	95	80	73	63800
O. pabda	60	90	85	10	4	------
O. pabda (using catfish hatchery)	130	90	87	50	30	4700
L. bata	90	90	85	80	75	36200

Biodiversity and fisheries potential of river Gomti in relation to the prevailing environmental conditions in Lucknow

Personnel: P. K. Varshney, P. M. Sherry, Alok Kumar Jain, A. K. Yadav, Z. J. Abidi, C. S . Chaturvedi, Ravi Kumar and Ram Bharose

Analysis of environmental and biological

factors from samples collected at four collection centres till April 2005 was completed. Analysis of biological parameters was completed. Data processing and report writing are in progress.

Culture of *Macrobrachium rosenbergii* and demonstration to the farmers

Personnel: Somdutt, S. S. H. Razvi, R. K. Upadhyay, V. G. Dubey and L. P. Bamalia

The experiments during the year were conducted in two sets. The first set of experiments was conducted in three *hapa*s of 10 m^2 each installed in one pond. Each *hapa* was stocked with 124 prawn seed (1.24 lakh/ha) on 1.09.05. The initial average length (21.27 mm) and average weight (0.047 g) were recorded. Feed was provided at 10% of initial body weight and continued as per the instructions given by the company. Data on important water parameters were recorded.

The second set of experiments was carried out with the prawn seed received from CIFE, Mumbai, on 29.09.05. This seed was acclimatized in hatchery for four days and stocked in four rearing ponds at 2000/pond (25,000/ha) on 03.10.05. Feed was provided at 10% of initial body weight and continued as per the instructions given by the company. The initial average length (20.45 mm) and average weight (0.049 g) were recorded. Data on important water parameters were collected.

As per the revised programme, *M. rosenbergii* stock was segregated into three groups, *i.e.,* big size (>65 mm) or jumpers, medium size (50-65 mm) and small size or laggards (<50 mm), and were restocked in *hapa*s 1, 2 and 3, respectively, on 01.11.05, *i.e.,* after 60 days of rearing. The periodical growth data of these rearranged stocks were recorded.

The *hapa* rearing experiment concluded on 17.03.06. The overall rearing period in *hapa* after the above stated segregation works out to be 135 days. The final average length and weight were found to be 116.334 mm and 14.046 g in *hapa* 1 (jumpers), 106.067 mm and 11.277 g in *hapa* 2 (medium size) and 102.066 mm and 9.511 g in *hapa* 3 (small size). The survival was 93.87% in *hapa* 1, 89.16% in *hapa*s 2 and 61.94% in *hapa* 3.

In the case of pond-reared prawns, the average length varied from 60.38 to 67.00 mm and average weight from 1.48 to 2.78 g after a rearing period of 45. However, the overall survival in ponds was found to be very poor. This experiment was terminated on 17.11.05.

Experiments on development of alternative shellfish and finfish culture in brackish water

Personnel: G. Venugopal, Rami Reddy, Murali Mohan, V. N. Acharyulu, R. R. S. Patnaik, B. Krishna Rao and A. Gurrayya

The experiments culture of *Scylla serrata,* culture of *Marsupenaeus japonicus* and culture of *Mugil cephalus* were conducted. During the second year of experiments, the following new experimental components have

been introduced and culture is in progress. A uniform stocking density of 5000 no./ha was adopted in all the experiments. Crablets were collected from natural resources and stocked in 12 culture ponds. All the experimental ponds (10 no.) were of 810 m^2 in area with a dimension of 90 x 90 x 1 m. However, the polyculture ponds (2 no.) were of 1000 m^2 in area, each with the dimensions 25x40x1.2 m.

Pond fencing was done with trawl net and

Silpolin cloth was fixed on the top of the net to prevent crab migration. No fertilizers/manures were applied.

Crablets collected from Koringa backwaters were procured at the cost of Rs.1.50 each per crablet. The stock was distributed uniformly in all the experimental ponds. The stocking particulars of different experimental components are given in Table 7.

The crabs were fed with chopped marine trash fish twice a day in the morning and evening. Marine trash fish were procured from the fishing harbour at weekly intervals and stored in a deep freezer.

The artificial feed compounded and pelleted by the Nutrition Division of the Central Institute of Brackishwater Aquaculture, Chennai, was applied daily at 2% of the body weight. The pellet dimension was 3 mm in diameter during the first month and subsequently, it was increased to 5 mm.

The first sampling after 20-27 days of culture was done for growth analysis, feed estimation and observing health condition of crabs. Details are given in Table 8. Water exchange was done.

A grow-out pond of 4000 m^2 in area was prepared and stocked with *M. japonicus* post-larvae supplied by CIBA on 05.12.2005. The 48-hour survival was observed to be 80% in *hapa*. The stocking density was 2.5/m^2. The culture will be carried out for 120 days. Sampling for growth was done and the details are given in Table 9.

Pelleted feed was provided thrice daily up to the third week and from the fourth week onwards, feeding was provided four times a day.

The seed of *M. cephalus* procured in the months of December 2005 and January 2006 from the natural resources in and around Kakinada is being reared for the purpose of culture experiments.

Seed production of Asian catfish (magur) in inland saline ecosystem

Personnel: N. K. Chadha, S. Raizada, M. Ali, Inderjit Singh, Ashok Kumar, Hasan Javed and Sanjeevan Kumar

Brood stock of magur was raised at the farm successfully and to confirm the breeding success in inland saline water, breeding experiments were conducted. A total of 13 females weighing 120-210 g were stripped and seven males weighing 95-115 g were sacrificed. A total number of 7612 of good eggs were obtained with 71.59% hatching success giving 5450 of hatchling; 3925 fry were recovered with 72% success, which were further reared up to 40 days and a total of 1890 fingerlings were obtained with 48.15% success. The water quality of ground-saline water used in magur hatchery was monitored.

Table 7. Stocking particulars of crablets

Pond no.	Date of stocking	Initial size at stoking			
		Stocking number	ABL (mm)	ABW (mm)	AB wt. (g)
All male					
5	5.11.05	400	44.68	64.76	47.24
6	5.11.05	400	44.68	64.76	47.24
All female					
7	5.11.05	400	45.12	64.56	48.92
8	5.11.05	400	45.12	64.56	48.92
Control (female & male 1:1)					
9	7.11.05	200 (female)	45.12	64.56	48.92
		200 (male)	44.20	63.10	45.80
10	7.11.05	200 (female)	44.80	63.20	45.80
		200 (male)	45.30	64.40	47.90
11	8.11.05	200 (female)	43.88	62.80	44.30
		200 (male)	45.40	64.80	48.00
With formulated pelleted feed					
12	10.11.05	200 (female)	43.40	61.20	43.20
		200 (male	45.40	65.20	49.20
13	10.11.05	200 (female)	44.20	63.10	46.00
		200 (male)	45.80	64.20	47.80
14	10.11.05	200 (female)	44.20	63.10	46.00
		200 (male	45.80	64.20	47.80
Polyculture					
15	12.12.05	*S. serrata* 500 *C. chanos* 250	45.2 240	64.2 --	45.1 125
18	12.12.05	*S. serrata* 500 *C. chanos* 250	46.2 240	66.1 --	49.2 125

Table 8. The results of sampling after 20-27 days of culture

Pond no.	Date of the latest sampling	Measurements		
		ABL (mm)	ABW (mm)	AB Wt. (g)
All male				
5	28.2.06	66.77	92.55	232.48
6	28.2.06	62.50	91.10	205.00
All female				
7	28.2.06	66.48	97.16	162.60
8	28.2.06	63.50	93.40	153.20
Control				
9	28.2.06	68.62	110.37	241.50
10	28.2.06	65.10	94.75	166.75
11	28.2.06	64.90	94.50	155.60
With formulated pelleted feed (male and female)				
12	28.2.06	65.10	94.75	166.75
13	28.2.06	64.90	94.50	155.60
14	28.2.06	66.25	98.00	163.35
Polyculture				
15	28.2.06	*S. serrata* 65.46	95.53	194
		C. chanos NR*	--	--
18	28.2.06	*S. serrata* 62.29	91.05	203.52
		C. chanos NR	--	--

*NR - Not Recorded

Table 9. Details of sampling of *M. japopnicus*

Stocking date	Culture duration (d)	Sampling date	Initial ABL (mm)	Initial ABW (g)	ABL (mm)	ABW (g)
5-12-05	78	21.02.06	12	0.394	87.5	4.875

4.2. Externally-funded projects

Developing aquaculture in degraded inland areas in India and Australia (Australian Centre for International agricultural Research)

Personnel: S. Raizada, N. K. Chadha and A.K.Verma

An experiment was undertaken for indoor rearing of prawn (*M. rosenbergii*) brood stock in heated water during winter season (November 2005 to March 2006). Two FRP tanks of 2000 l capacity were filled with fresh water and heated with the help of 1000-W electric immersion rod fitted with thermostat to control upper temperature limit to less than 31^{0}C. Each tank was stocked with 50 number of advanced stage juveniles of both the sexes of size ranging from 10 to 35 g. The tanks were provided with sufficient hideouts of cement pipes (7.5 cm diam.) and continuous aeration from a portable aerator was resorted to. The prawns were fed with boiled fish flesh and commercial prawn diet alternately. Severe mortality of newly moulted prawns was seen due to cannibalism by the hard-shelled prawns. Subsequently, the second pair of chelate legs of all the male prawns was severed from the ischium and merus joint, and potassium permanganate was applied. The number of prawns was also maintained at 50 in each tank. This application stopped further mortality in both the tanks and cent per cent survival was obtained in both the tanks. Both gravid male and female population along with berried females were estimated frequently all through the experiment. This practice made it possible to get berried females round the year and will help the hatchery operators of the northern region of the country where winter is severe to take up seed production programme of freshwater prawn in the early summer months.

An experiment was conducted to rear post-larvae of prawn (size 11-12 mm) in heated water under indoor conditions during severe winter season. Two round FRP tanks of 500-l capacity filled with 300 l fresh water were stocked each with 700 numbers of prawn post-larvae (2.3 PL/l). Each tank was fitted with thermostatic glass heater to maintain a temperature between 28 and 30^{0}C and was provided with continuous aeration from a portable aerator. The larvae were fed on a commercial prawn diet during the 85 days of culture period and provided with sufficient hideouts. The experiment was terminated on 22.02.2006. In all, 196 and 186 prawn juveniles were procured from the tanks, which equal to respective survival of 28.0 and 26.5%. The average size of the juveniles at harvest was length 57.58 mm and 1.76 g. The low survival and poor growth of prawn could be due to erratic power supply, which restricted the maintenance of controlled temperature round the clock. However, this practice has made possible to rear post-larvae produced in early winter to get juvenile seed for rearing in ponds during early summer months.

An experiment was carried out to find out the effect of total hardness of raw saline water on the survival of prawn larvae during July 2005. The experiment was carried out in 35-l plastic tubs in triplicate sets. The raw saline ground water of 12‰ salinity having hardness of 3350 mg/l was taken as control and the four test media having hardness levels to 2650, 2144 and 1700 mg/l were prepared through the de-ionization process. Since the raw saline water is poor in potassium, amendment with potassium chloride was made equivalent to coastal sea water. All the test containers were stocked with 600 specimens (40 larvae/l) of freshly hatched prawn larvae and provided continuous aeration, and resorted to normal feeding schedule with artemia nauplii and egg custard. Gradual mortality was noticed in all the treatments with variations. On the eighth day, larvae were found surviving in all the media but total mortality was seen in the media having hardness levels 2144 and 1700 mg/l. On the 16th day, total mortality was also observed in the control set. However, some larvae were seen surviving up to day 16 in the medium-2 having total hardness 2680 mg/l. Total mortality in this medium was also seen

thereafter. The study thus confirmed that total hardness of water might not be the limiting factor for the survival of prawn larvae.

An experiment was conducted to evaluate the optimum Mg^{2+}/Ca^{2+} ratio for the survival and growth of prawn larvae reared in amended ground-saline water. Five media were prepared by reducing the calcium level first by de-ionization process and supplementation with magnesium so as to maintain the Mg^{2+}/Ca^{2+} ratio in the ranges 2.00-2.10, 2.49-2.54, 2.97-3.13, 3.47-3.60 and 4.10-4.20. The salinity of the water was maintained at 12‰ and the level of potassium was amended to 115.9-119.3 mg/l in all the media. Twenty litres of the so-prepared media were filled in 35-l plastic tubs in triplicate sets having provision for continuous aeration. A total of 800 freshly-hatched prawn larvae from the same batch of brooder were stocked in each tub on 6.9.2005, and common husbandry methods of feeding and water exchange were followed. It was concluded that the optimum Mg^{2+}/Ca^{2+} ratio for larval rearing of prawn using amended ground water is between 2.49 and 2.54.

Produced 30,000 prawn seed using amended ground-saline water continuously for the second consecutive year. For the first time, commercial grade magnesium chloride was used and found to be equally effective to chemical grade for amendment of water.

The level of potassium in inland ground saline water at 5.0‰ is less by six times than the normal coastal sea water and the catla grown in this water exhibits very poor growth. Hence, the effect of potassium was assessed through artificial supplementation on the growth of catla in a triplicate set of cement ponds of size 200 m^2 along with a control without any potassium supplementation. The treatments received 50% of potassium level equivalent to coastal sea water by the addition of commercial grade muriate of potash. The ponds were fertilized with raw cattle dung and diammonium phosphate at monthly intervals, and stocked with 100 catla juveniles from the same batch. The fish were reared up to 10 months from August 2004 to May 2005 with cent per cent survival in all the ponds. The pond water quality was monitored at monthly intervals. The fish reared in potassium-amended water showed marked increments in length and weight. The 'r' values for the treated ponds were calculated to be 0.9057, 0.944 and 0.9025, respectively, which were comparatively higher than 0.719 in the control pond. These values indicated that the fish reared with amended level of potassium has better length and weight gain than the fish reared in raw ground-saline water.

Genetic Improvement of *P. monodon* through selective breeding for growth and white spot disease resistance (Indo-Norwegian Programme of Institutional Cooperation)

Personnel: Gopalkrishna and S. Jahageerdar

Initial survey was conducted to find out the possibilities to get the full-sib families from Andhra Pradesh. The hatchery owners and farmers were contacted for providing family production and raring facilities. In Mumbai and nearby areas too, the farmers were contacted and grow-out facilities fixed.

The Institute organized the International Symposium on Fish Genetics and Health Management during 9-10 February 2005 followed by the International Workshop on Tagging. The personnel underwent a training programme on quantitative genetics and application of various types of software, and a course on survival analysis at AKVAFORSK, Norway, from 14 March to 14 May 2005. They visited many hatcheries and the commercial farms of salmon and trout, visited the breeding nucleus at AFGC, Sundalsora, and challenge test facilities at Trondiehm. Tagging equipment was brought from Norway for tagging the shrimp.

Bacterial fertilizers for aquaculture (Indian Council of Agricultural Research - AP Cess)

Personnel: P. K. Pandey, C. S. Purushothaman and A. Vennila

The necessary infrastructure facilities are being developed. The standardization of analytical techniques is under progress. The water and sediment samples were collected from Powai Lake and Saphale. The work is under progress.

National Risk Assessment Programme for fish and fish products for domestic and international markets (Indian Council of Agricultural Research - AP Cess)

Personnel: S. Basu, B. B. Nayak, K. Pani Prasad and A. K. Padmanabhan

Thirty-five seafood samples from landing centres, markets and seafood export houses were analysed for pathogenic bacteria like *Salmonella*, *Vibrio, Escherichia coli,* faecal streptococci and *Clostridium,* and the results were interpreted. These results are a part of the database generated to validate risks associated with the Indian seafood to protect India's interest in the WTO regime. The samples were also analyzed for heavy metals like Hg, Pb, As, Cd, Cr and Zn.

Population genetic evaluation of growth of mahseer (Indian Council of Agricultural Research - AP Cess)

Personnel: Gopalkrishna

Since the objective was to genetically evaluate the growth performance of mahseer from different geographical locations, a survey was conducted to find out the availability of the species in different geographic locations. The places where the survey was conducted include Uttaranchal, Himachal Pradesh, Jammu and Kashmir, Rajasthan and Gujarat. The selected areas of these states were surveyed and wherever the specimens were available, were collected to be brought to Lonavla, the experimental site for further breeding and rearing to evaluate the stock.

The facilities for breeding are in place and the maturity status of the breeding individuals stocked at the Tata Electric Company's farm at Lonavala was monitored every 15 days. Tours were undertaken to Kolkata, Shillong, Sikkim and Arunachal Pradesh to find out the availability of mahseer (*Tor tor*) stock. In the northeastern states, sufficient stock of the species for breeding purpose is not available.

Identification of salt-tolerance genes in marine tiger shrimp *Penaeus monodon* (Indian Council of Agricultural Research - AP Cess)

Personnel: Aparna Chaudhari

Two groups of *P. monodon* post-larvae were acclimatized slowly to 35 and 5‰, and grown up to a size of 25 g. Gills and muscle tissues were collected and appropriately stored for mRNA isolation.

Total RNA was isolated from fresh and stabilized gill and muscle tissues. Messenger RNA was isolated and used to synthesize cDNA. Following subtractive hybridization of cDNAs of shrimp acclimatized to different salinities, the cDNAs differentially expressed in the shrimp muscle at 5‰ were amplified and six amplicons were visualized on agarose gels. These have been cloned and sequenced. These sequences were used to probe *P. monodon* DNA by Southern hybridization for confirmation. Reverse subtractive hybridization was also carried out and five sequences differentially expressed in muscle tissue of specimens acclimatized to higher salinity were amplified. These sequences have also been cloned and sequenced, and confirmed by Southern hybridization.

Studies on the development of DNA and biochemical markers of Asian seabass, *Lates calcarifer* (Bloch), from Indian waters (Indian Council of Agricultural Research - AP Cess)

Personnel: S. D. Singh

Fish samples have been procured from the east and west coasts (Chennai, Mumbai, etc.), and genomic DNA has been isolated and purified from fin and liver tissues. Quality and

integrity of genomic DNA were found to be very good. Few random primers have been used to produce polymorphic DNA fingerprints after pre-standardization.

Application of probiotics in fish nutrition (Indian Council of Agricultural Research - AP Cess)

Personnel: Archana Sinha

Two indigenous strains of microflora, (*Bacillus* sp. SM2 and ST1), isolated from mrigal *(Cirrhinus mrigala)* were selected on the basis of their wide spectrum of action on both Gram-positive and Gram-negative bacteria. It did not result in fish mortality when challenged at $4x10^5$, $4x10^6$ and $4x10^7$ cells/ml by inter-peritoneal injection. The growth performances and survival of probiotic-fed Indian major carps of the present study were better compared to control groups, probably due to the supply of unknown growth factors and immunostimulation. The fishes fed at 5.0×10^7 cells/ml and 5.0×10^6 cells/ml showed significant ($P < 0.05$) improvement in weight gain and SGR compared to the control group. Fishes fed with spore-forming *Bacillus* sp. at 5.0×10^5 cells/ml and those fed with non-spore forming *Bacillus* sp. at different doses showed insignificantly ($P > 0.05$) higher weight gain and SGR compared to the fishes in T_0 tanks (control groups). Significant improvement ($P < 0.05$) in FCR compared to the control groups could only be seen for the fishes fed with spore-forming *Bacillus* sp. at 5.0×10^6 cells/ml. Sequentially improved percentage change in CF has been observed with the increased dose of spore-forming *Bacillus* sp. in basal diet.

The pathogens were transmitted to the experimental fishes by inter-peritoneal injection on the first day of the experiment. In the challenge test with *Aeromonas hydrophila*, the survival in the treatment group (T_1) fed with *Bacillus* sp. at $5.0x10^7$ cells/ml was higher (86.67%) followed by T_2 (83.33%) and T_3 (63.33) while in the control group T_0, the survivality was the minimum being 36.67%. The survivality in the negative control group showed the trend as $T_2 = T_1 > T_3 = T_0$. The percentage of fish exhibiting fin/tail rot was maximum (63.33) in control (T_0) followed by T_3 (40.00), T_2 (16.67) and T_1 (13.33). Similarly, the infectivity percentage in negative control group showed the trend as $T_3 = T_0 > T_2 = T_1$. The differences between the infected and uninfected groups, and between the different probiotic-fed groups were, however, found to be statistically insignificant ($P > 0.05$)

Predictive modelling of Bombay duck landings off the northwest coast of India (Department of Ocean Development, Government of India)

Personnel: R. S. Biradar

Univariate time series models were fitted to the annual Bombay duck landings based on estimated annual landings for the period 1961-2000 for the original (untransformed) and log-transformed data. The data for the years 2001 and 2002 were used as test data, and were not used in the generation of models. Landings in these years were compared with the forecasts for the same years. Different smoothing techniques, spectral analyses, state space and ARIMA models were used in the study. Akaikes Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) were worked out for different models. The model with the lowest AIC and SBC is considered as the best. Other accuracy measures such as mean absolute error (MAE) and mean absolute percentage error were also worked out.

ARIMA models generally showed better performance. ARIMA (0,1,1) was found to be suitable for forecasting the Bombay duck landings of Maharashtra as well as Gujarat coasts. However, for the combined data of the northwest coast, ARIMA (1,1,1) was suitable. For log-transformed data, ARIMA (1,0,0), ARIMA (1,0,1) and ARIMA (1,0,0) were suitable for Maharashtra, Gujarat and northwest coast, respectively. The models developed based on the original data gave higher forecasts as compared to log-transformed data.

Studies on germ-plasm preservation of marine algal biodiversity (Department of Ocean Development, Government of India)

Personnel: Geetanjali Deshmukhe

Maharashtra coast was surveyed and the marine algal biodiversity and biomass were recorded for Malvan, Ratnagiri, Srivardhan and Colaba. Five new species namely, *Ulva lobata, U. propenguinensis, Pseudobryopsis* sp. (Chlorophyta), *Grateloupia watti* and *Gelidiopsis* sp. (Rhdodophyta) have been recorded along the coastline. Cryopreservation of *Gracilaria corticata* apical cells gave 80 to 90% survival rate.

Integrated aquaculture for sustainable resource management in bio-villages (Department of Biotechnology, Government of India)

Personnel: S. N. Ojha

During the year 2005-06, two new activities were introduced. They were collection of seed of seabass and wild crabs for fattening. Since there was a severe flood, culture activities could not be taken up. However, in the absence of fund released during the extension period, some demonstrations were conducted (Table 10).

In addition, some activities were also carried out under the Earn while You Learn Programme (Table 11).

Enhancement of fish production through cage aquaculture (Department of Biotechnology, Government of India)

Personnel: Somdutt

Under this project, the finalization of technical design of cages was done. Tenders were finalized. Site selection for installation for cages was also done. Cages were fabricated and installed in Halali Reservoir. Rearing of carps is in progress.

The curricula for training programmes under this project were also finalized. Three training programmes were conducted under this programme and the senior staff of this

Table 10. Different demonstrations conducted during 2005-06

Topic	Date	Period (d)	Village	Participants (no.)
Harvesting and handling of fish	13/04/05	1	Mahim	10
Harvesting and handling of fish	15/04/05	1	Masvan	10
Banana cultivation and horticulture	22/04/05	1	Mahim	15
Organic farming	23/04/05	1	Mahim	15
Nursery management practice	08/07/05	1	Mahim	10
Freshwater prawn hatchery	10/07/05	1	Mahim	10
Stocking of carp seed in village pond	10/08/05	1	Mahim	7
Fish feed production	20/08/05	1	Mahim	12
Fish feed manufacturing and application	10/09/05 to 12/09/05	3	Mahim	15
Total				104

Table 11. Earn while You Learn Programmes conducted

Topic	Date	Period (d)	Village	Participants (no.)
Harvesting and handling of fish	13/04/05	1	Mahim	7
Harvesting and handling of fish	15/04/05	1	Mahim	7
Collection of seabass seed	02/09/05	15	Mahim	10
Collection of wild crab for fattening	05/09/05	5	Mahim	9
Total				33

centre delivered guest lectures in these programmes.

Thermal tolerance of some important fish species of Kali River, Karnataka (Board on Research in Nuclear Sciences)

Personnel: A. K. Pal

Fish abundance in the impacted region of reservoir was monitored and compared to fish catch in Hartuga Village (500 m away from discharge point) or at Virgae Village (15 km upstream of the reservoir). Thermal tolerance of selected fish species was investigated in the laboratory and was found to be in the range of 11.06-42.6°C. Typical CTMax values ranged between 38 and 42.6°C.

Oxygen consumption rate of fishes increased with the increase in water temperature. Activities of a number of enzymes involved in the metabolism (malate and lactate dehydrogenases, aspartate and alanine aminotransferases, alkaline and acid phosphatases, and acetylcholinesterase) generally increased with rising temperature. However, activities of acetylcholinesterase in brain and liver, and alkaline and acid phosphatases in liver decreased with the increase in temperature. These enzymes are known to respond to any stress the organism faces and the marginal increase in their activities at higher temperature reflects the ability of fish to avoid these stresses.

Histopathological studies showed that up to a T of 7°C, no significant effect was observed on liver, gill and skin but alteration in histoarchitecture was seen at T of 10°C. The effect of elevated temperature on reproductive biology of a dominant fish, *Labeo calbasu,* was also investigated. The optimum temperature range for development and hatching of this fish was found to be 31-33ºC, and embryonic development was faster with increasing temperature, but at T of 10°C, hatching percentage decreased and embryos were malformed. The data clearly show that the prevailing temperature of the reservoir is compatible with the growth and reproduction of resident fish species and even in the mixing zone,

the fish are unlikely to experience any adverse effect of thermal discharge on their growth and development.

A video documentary on the practical laboratory method for students on thermal ecology was prepared. This visual aid demonstrates various techniques involved in studying thermal ecology of fish. The documentary encompasses techniques like thermal tolerance by dynamic method, biochemical assays of various enzymes and molecular techniques like western blotting for determination of HSP70.

The documentary "…and quiet merges the warmth…" is a unique endeavor made by CIFE under this project. The documentary compiles research activities in various areas of thermal ecological studies carried out in India. The documentary is made in collaboration with eight different institutes, *viz.*, National Environmental Engineering Research Institute, Madras University, Mangalore University, M. S. University, Pondicherry University, ESL Kaiga and Kalpakam Atomic Power Station.

Potential uses of thermal effluents of Nuclear Power Plants for Carp Breeding and Seed production (Board on Research in Nuclear Sciences)

Personnel: A. K. Pal

The project is intended to assess the potential use of thermal effluents for carp breeding and seed production. As per the technical programme, a hatchery and rearing facility were designed for establishment at the project site (near the reservoir) in Kaiga, Karnataka, and the work is in progress. Preliminary trials are also being carried out to assess the effect of temperature and 0.1 mg/l chlorine levels on early developmental stages of *C. carpio*. CTMax and CTMin values followed a definite increasing pattern with increasing acclimation temperatures (26, 31, 33, 363°C). In the study, the presence of residual chlorine (0.1 mg/l) decreased the CTM limits of *C. carpio* irrespective of the different acclimation temperatures. Persistent use of chlorine at 0.1 mg/l decreased the chlorine tolerance in *C. carpio*. Under the influence of chlorine, enzyme activities (LDH, MDH, G6PDH, ALP, AST, ALT) in different organs (liver, intestine and muscle) were affected with the increase in acclimation temperature. However, levels of haemoglobin in *C. carpio* in the group were inhibited by the presence of chlorine even though that aspect did not affect the oxygen consumption. Erythrocytes increased with increasing temperatures in the control group due to the increased demand of oxygen consumption. A significantly lower count was recorded at higher temperature in the chlorine treatment suggesting the inhibitory effect of chlorine affecting the production of erythrocytes generally present in higher acclimation temperatures. Total serum protein was found to decrease with increasing temperatures in both the control as well as chlorine treatment. Leukocyte count was higher in the control groups. NBT assay revealed lower immune response of the chlorine group and was negatively related with increasing temperatures. Acclimation temperatures influenced the induction of HSP70 at higher temperatures. Overall results indicate an inhibitory effect on metabolic enzymes and immune status with the persistent use of chlorine at higher acclimation temperature.

Nutritional requirement for feed development and feeding strategies of indigenous freshwater ornamental fishes having export value

Personnel: Archana Sinha

Experimental fishes chanda (*Chanda ranga*) and titke punti (*Puntius ticto*) are being acclimatized in the laboratory. The feeding biology of the fishes is being studied.

4.3. Technology Refinement Projects

Integrated fish and prawn farming systems in rural areas of Sunderbans (West Bengal) to motivate local pisciculturists by setting up demonstration centres of CIFE

Personnel: P. K. Roy

Brood stock management practice and application of carp pituitary hormone for better and early maturity were demonstrated among local pisciculturists. Induced breeding demonstration of Indian major carps at saline areas of Sunderbans was conducted. Raised 2.29 lakhs of advance and distributed among the poor pisciculturists. Demonstrated paddy, fish and prawn culture in paddy fields. Paddy production at 2200 kg/ha in six months along with 550 kg/ha fish and 556 kg/ha was demonstrated. Demonstrated the culture of *P. monodon* along with *Liza parsia* with productions at 533 and 670 kg/ha in six months. Demonstrated the culture of *Lates calcarifer* with a six monthly production of 500 kg/ha. Culture of Indian major carps, rohu, catla and mrigal, with a production of1000 kg/ha/yr was also demonstrated in saline areas.

Development and popularization of fisheries in northeastern states

Personnel: S. C. Mukherjee, R. C. Das, P. K. Ghosh and K. Chandra

Three states, *i.e.*, Mizoram, Tripura and Manipur, were selected for the development of fisheries. Supervision of the ongoing composite culture and integrated farming was carried out in Aizwal and Imphal.

Adaptive radiation of existing pisciculture technologies in Barabanki district

5 Educational achievements

5.1. Results

S. no.	Name of the Programme	No. of successful candidates
1.	Ph.D.	18
2.	M.F.Sc. (Fish Pathology and Microbiology)	4
3.	M.F.Sc. (Fish Nutrition and Biochemistry)	4
4.	M.F.Sc. (Fisheries Resource Management)	4
5.	M.F.Sc. (Fish Business Management)	3
6.	M.F.Sc. (Inland Aquaculture)	5
7.	M.F.Sc. (Fish Genetics and Biotechnology)	4
8.	M.F.Sc. (Post-harvest Technology)	4
9.	M.F.Sc. (Mariculture)	5
10.	M.F.Sc. (Freshwater Aquaculture)	5
11.	P. G.. Diploma in Inland Fisheries	25
	Total	81

The following are the Ph.D. theses and M.F.Sc. dissertations on which degrees were awarded during the year:

5.2. Ph.D. Theses

S. no.	Student	Title	Guide
1	Binu Verghese Ph.D.-100 (1999-2002)	Nutritional Studies on Sebae Anemonefish, *Amphiprion sebae* Bleeker 1853, with Special Reference to Protein and Lipid Requirements	R. Paul Raj
2	K. K. Anikuttan Ph.D.-111 (1999-2002)	Pathology of Aflatoxicosis and Heavy Metal Toxicity in Pearlspot, *Etroplus suratensis* (Bloch)	K. C. George
3	N. P. Anikumari Ph.D.-116 (1998-2001)	Studies on the Use of Probiotics in the Larval Rearing of the Shrimp *Penaeus monodon* (Fabricius 1798)	K. S. Mohamed
4	Juliet Joseph Ph.D.-130 (2000-03)	Economic Analysis of Externalities in Coastal Mariculture	R. Sathiadhas
5	S. L. Charatkar Ph.D.-134 (2001-04)	Study of Shoreline Change of Dakshina Kannada and Udupi Districts of Karnataka using Remote Sensing and GIS	R. S. Biradar
6	Santosh Y. Metar Ph.D.-135 (2001-04)	A Study on Biology and Population Dynamics of *Saurida tumbil* (Bloch, 1795) from Mumbai Waters	S. K. Chakraborty
7	A. Balasubramanian PH.D.-136 (2001-04)	Gear Selectivity Studies on Certain Commercially Important Carangid Fishes of Kanyakumari Coast, Tamil Nadu	B. Meenakumari
8	P.K. Parida Ph.D.-137 (2001-04)	Biology and Stock Assessment of Soldier Catfish, *Osteogeneiosus militaris* (Linnaeus, 1758) from Mumbai Waters	S. K. Chakraborty
9	M. Rajalekshmi Ph.D.-140 (2001-04)	Protein Stabilizing and Gel Enhancing Effects of Chitosan on the Myofibrillar Protein Concentrate from Threadfin Bream (*Nemipterus japonicus)*	P. T. Mathew
10	Surendra B. Patange Ph.D.-145 (2001-04)	Studies on Bacterial Decarboxylase Activity associated with Spoilage Fish	M. K. Mukundan
11	Harendra Prasad Ph.D.-150 (2001-04)	Microsatellite Analysis of the population structures of Asian Seabass (*Lates calcarifer)* from India	S. D. Singh
12	S. M. Manush Ph.D.-151 (2001-04)	Stress Responses in *Macrobrachium rosenbergii* and its Amelioration	A. K. Pal
13	A. V. Barse Ph.D.-156 (2001-04)	Impacts of Endocrine Disrupters on *Cyprinus carpio* (Linn.)	T. Chakrabarti NEERI, Nagpur
14	Kedar Nath Mohanta Ph.D.-159 (2001-04)	Nutritional Requirement, Feed Formulation and Production of *Puntius gonionotus* (Bleeker)	S. N. Mohanty
15	Johnson Jiribi Balli Ph.D.-164 (2002-05)	Study on Biology and Population Dynamics of *Harpodon nehereus* (Hamilton, 1822) from Mumbai Waters	S. K. Chakraborty
16	Jiten Sarma Ph.D.-177 (2002-05)	Effect of Cryoprotectants on Biochemical and Functional Properties in Common Carp, *Cyprinus carpio*, during Frozen Storage	Jose Joseph
17	R. K. Majumdar Ph.D.-178 (2002-05)	Technology Evaluation and Improvement of *Lona Ilish*	S. Basu
18	O. Sudhakar Ph.D.-186 (1995-98)	Biomonitoring of Eutrophication of Powai Lake, Mumbai	J. P. George CMFRI, Kochi

5.3. M.F.Sc. Dissertations

S. no.	Student	Title	Guide
Fish Pathology and Microbiology			
1.	Arup Nath FPM-12 (2003-05)	Molecular Identification of Luminescent Bacteria	B. B. Nayak
2.	Pankaj Sarkar FPM-13 (2003-05)	Isolation and Characterisation of Phosphate Solubilizing and Phosphatase Producing Bacteria in Coastal Mangrove Area	C. S. Purushothaman
3.	Ritesh Ranjan FPM-15 (2003-05)	Effect of White Spot Syndrome Virus (WSSV)-treated Artemia on the Immune Response of *Penaeus monodon*	S. C. Mukherjee
4.	Malay Choudhury FPM-16 (2003-05)	Separation and Partial Characterization of Serum Immunoglobulin of *Lates calcarifer* (Bloch, 1790)	K. Pani Prasad
Fish Nutrition and Biochemistry			
1.	A. K. Jha FNB-11 (2003-05)	Growth and Immunomodulation of *Catla catla* Fingerlings through Dietary Immunonutrients	A. K. Pal
2.	Sougat Misra FNB-12 (2003-05)	Effect of Dietary EPA and DHA Supplementation on Carbohydrate Utilization in *Labeo rohita* Fingerlings.	N. P. Sahu
3.	Mr. Santosh Karanth FNB-13 (2003-05)	Dietary modulation of fatty acid profile in *Labeo rohita* (Hamilton) fingerlings	G. Venkateshwarulu
4.	Biji Xavier FNB-14 (2003-05)	Effect of De-tannification and Exogenous Enzymes on Growth and Nutrient Utilization of *Labeo rohita* Fingerlings	K. K. Jain
Fisheries Resource Management			
1.	Divya Alice Varkey FRM-185 (2003-05)	Predictive Modelling of Marine Fish Landings of Kerala Coast	R. S. Biradar
2.	Rajeev Kumar FRM-186 (2003-05)	Studies on *Protonibea diacanthus* (Lacepede, 1802) from Mumbai Waters	S. K. Chakraborty
3.	M. K. Nalwa FRM-187 (2003-05)	Biology of *Sepia aculeata* (d'Orbigny, 1848) along Mumbai Waters	S. K. Chakraborty
4.	M. U. Shivappa FRM-189 (2003-05)	Bioactive Potential of Sea Anemone *Anthopleura midori* of Mumbai Coast	K. Venkateshvaran

Fish Business Management

1.	B. Debnath FBM-06 (2003-05)	Resource Cost Ratio Approach to Promote Aqua-business Units - Selected Case Studies from East and North-eastern India	R. S. Biradar
2.	Pravin R. Patil FBM-08 (2003-05)	A Study on Retail Fish Marketing in Mumbai	S. N. Ojha
3.	Sujeet Rajak FBM-10 (2003-05)	Market Research and Market Entry Strategy of Shrimp Feed in the States of Gujarat, Maharashtra and Orissa	Arpita Sharma

Inland Aquaculture

1.	A.K. Prusty IAC-164 (2003-05)	Effect of Dietary Tannic Acid on Nutrient Utilization, Metabolic Response and Growth of *Labeo rohita* Fingerlings	N. P. Sahu
2.	Pradyut Biswas IAC-165 (2003-05)	Effect of Exogenous Supplementation of Microbial Phytase and L-Lysine on Growth and Nutrient Utilization of P*enaeus monodon* (Fabricius) juvenile	A. K. Reddy
3.	T. Vani IAC-166 (2003-05)	Evaluation of Toxic Effect of Deltamethrin on*Catla catla* (Ham.) Fingerlings and its Amelioration through Dietary Ascorbic Acid	Neelam Saharan
4.	E. Suresh IAC-167 (2003-05)	Intraspecific Genetic Variation in *Mugil cephalus* by using RAPD Profiles	V.K. Tiwari
5.	S. D. Barma IAC-168 (2003-05)	Efficacy of Crude Root Extract of *Gliricidia sepium* Plant as Piscicide in Aquaculture Systems	A. K. Reddy

Fish Genetics and Biotechnology

1.	P. Gireesh Babu FGB-11 (2003-05)	Design and Engineering of Biosensor Gene Constructs to produce Organisms Capable of Sensing Aquatic Heavy Metal Toxicity	A. Chaudhari
2.	Amrish Sharma FGB-12 (2003-05)	Study of Genetic Variation in *Macrobrachium rosenbergii* using Random Amplified Polymorphic DNA Technique	W. S. Lakra
3.	Beena Kumari FGB-13 (2003-05)	Estimation of Genetic Variation in the Hatchery-bred Stocks of Rohu (*Labeo rohita)* on Truss and RAPD Analysis	S. Jahageerdar
4.	T. C. Mourya FGB-15 (2003-05)	Nucleic Acid Estimation and its Correlation with Certain Economic Traits of Mahseer *Tor tor* (Ham.)	Gopal Krishna

Post-harvest Technology

1	Chintu M. Raju PHT-28 (2003-05)	Changers in the Free Amino Acid Pool of Fish and Shellfish during Ice Storage	Suseela Mathew CIFT, Kochi
2	S. Tanuja PHT-29 (2003-05)	Antibiotic Resistance of Aquatic Bacteria and their Plasmid Profile	P. K. Surendran CIFT, Kochi
3	K. V. Anoop PHT-30 (2003-05)	Study of Biogenic Amine Formation in Fishes and Shellfishes stored in Ice and Ambient Temperature	K. Ashok Kumar CIFT, Kochi
4	I. P. Lakshmisha PHT-31 (2003-05)	The Effects of Freezing Methods on Quality Changes during Freezing and Frozen Storage of Mackerel	C. N. Ravishankar CIFT, Kochi

Mariculture

1	Asha Augustine MC-85 (2003-05)	Growth Kinetic Profiles of Selected Fungal Isolates in Solid-state Fermentation	Imelda Joseph CMFRI, Kochi
2	G. Gogularamanan MC-86 (2003-05)	Evaluation of Simple Whole-cell killed Vaccine Preparation from a Virulent Strain of *Vibrio anguillarum* on Humoral Antibody Response in Grouper	K. S. Sobhana CMFRI, Kochi
3	P.C. Mishra MC-87 (2003-05)	Influence of Salinity on Growth, Physiology and Phycocolloid Content of *Kappaphycus alvarezii*	Reeta Jayasankar CMFRI, Kochi
4	Sujoy Biswas MC-88 (2003-05)	Culture of New Live-prey Organisms with Focus on Mysids	Rani Mary George CMFRI, Kochi
5	A. R. Gupta MC-89 (2003-05)	Study on Biofouling associated with Bivalve Farm in Thangaserry Bay and Ashtamudi Lake	T. S. Velayudhan CMFRI, Kochi

Freshwater Aquaculture

1	Aditya N. Misra FWA-26 (2003-05)	Profiling of Milt Proteins of Indian Major Carp, *Labeo rohita,* in Cryopreservation Process	S. D. Gupta, CIFA, Bhubaneswar
2	Prajnanu R. Sahoo FWA-27 (2003-05)	Construction of a Genomic Library in *Lamellidens marginalis* (L.) for Development of Microsatellite Markers	P. Das, CIFA, Bhubaneswar
3	R. K. Chand FWA-28 (2003-05)	Immunomodulation by Dietary Lactoferrin in the Giant Freshwater Prawn *Macrobrachium rosenbergii* (de Man)	P. K. Sahoo, CIFA, Bhubaneswar
4	A. A. Naqvi FWA-29 (2003-05)	Effect of Manganese, Iron and Ammonia-N on Survival, Growth and Feeding of Juvenile Giant Freshwater Prawn *Macrobrachium rosenbergii*	S. Adhikari, CIFA, Bhubaneswar
5	Vijay Kumar FWA-30 (2003-05)	Studies on the Effect of Dietary Antaxanthin on Growth and Immune Responses of *Macrobrachium rosenbergii* (de Man)	Bindu R. Pillai, CIFA, Bhubaneswar

5.4. Enrollments

S. No.	Name of the Programme	Number of Students Admitted
1.	Ph.D. (Fish Pathology and Microbiology)	3
2.	Ph.D. (Fish Nutrition and Biochemistry)	2
3.	Ph.D. (Fisheries Resource Management)	7
4.	Ph.D. (Fish Business Management)	1
5.	Ph.D. (Inland Aquaculture)	7
6.	Ph.D. (Fish Biotechnology)	4
7.	Ph.D. (Post-harvest Technology)	3
8.	Ph.D. (Mariculture)	1
9.	M.F.Sc. (Fish Pathology and Microbiology)	5
10.	M.F.Sc. (Fish Nutrition and Biochemistry)	5
11.	M.F.Sc. (Fisheries Resource Management)	5
12.	M.F.Sc. (Fish Business Management)	5
13.	M.F.Sc. (Inland Aquaculture)	5
14.	M.F.Sc. (Fish Genetics and Biotechnology)	5
15.	M.F.Sc. (Post-harvest Technology)	5
16.	M.F.Sc. (Mariculture)	5
17.	M.F.Sc. (Freshwater Aquaculture)	5
18.	P.G. Diploma in Inland Fisheries	23
	Total	96

6 Extension achievements

The following are the major extension achievements during the year under report.

6.1 Short-term Training Programmes

S. no.	Title	Period
1.	Advanced Techniques in Biochemical Analysis	12 - 26 April 2005
2.	Farm Lay-out Design and Instrumentation	16 - 30 May 2005
3.	Disease Diagnosis and Treatment Methods for Shrimp, Scampi and Fish	05 -10 June 2005
4.	Scampi Hatchery Management and Grow-out Techniques	13 - 19 June 2005
5.	Aquatic Microbiology in Aquaculture	13 - 22 June 2005
6.	Seed Production and Culture of Carps and Magur	28 June -10 July 2005
7.	Carp Seed Production and Nursery Management	11 - 18 July 2005
8.	Soil and Water Management for Sustainable Aquaculture	19 - 25 July 2005
9.	Ornamental Fish Culture	26 July - 1 August 2005
10.	Disease Management in Fisheries	15 - 24 July 2005
11.	Comprehensive Training in Freshwater Giant Prawn Culture	16 July 2005
12.	Culture and Breeding of Catfish	19 - 25 July 2005
13.	Carp Breeding and Seed Rearing	22 - 31 July 2005
14.	Breeding and Culture of Carps and Magur	29 July - 04 August 2005
15.	Carp Breeding and Culture	08 -16 August 2005
16.	Management of Giant Freshwater Prawn Hatchery and Grow-out Systems	16 - 30 August 2005
17.	Culture and Hatchery Seed Production of Freshwater Prawn	17 - 23 August 2005
18.	Magur Hatchery and Culture Techniques	18 - 24 August 2005
19.	Fish Seed Rearing	22 - 24 August 2005
20.	Pearl Culture	12 - 20 September 2005
21.	Catfish Breeding and Culture	19 - 26 September 2005
22.	Scampi Hatchery Management and Grow-out Techniques	01 - 07 October 2005
23.	Aquarium Management and Culture of Ornamental Fish	10 - 24 October 2005
24.	Hatchery Management and Grow-out Techniques of Scampi and Magur	18 - 24 October 2005
25.	Freshwater Giant Prawn Culture	20 - 26 October 2005
26.	Scampi Hatchery Management and Grow-out Techniques	21 - 27 October 2005
27.	Genetics and Molecular Techniques in Fisheries	13 - 22 February 2006
28.	Ornamental Fish Culture and Breeding	21 - 28 February 2006
29.	*Matsyaki Pathshala*	01 - 07 March 2006

Special Training Programme
As per the demand from the Government of Bihar, a special training programme on Giant Freshwater Prawn Seed Production and Culture was organized from 06 to 17 September 2005 for 27 farmers from Bihar.

6.2 Participation in exhibitions

S. no.	Event and Venue	Duration
1.	*Raitu Sadassu*, Government College, Rajahmundry, Andhra Pradesh	27 - 28 May 2005
2.	*Chetna Diwas*, Village Jhalri , Haryana	24 June 2005
3.	Comprehensive Training in Freshwater Giant Prawn Culture, Barabanki, Uttar Pradesh	16 July 2005
4.	International Exhibition on Food, Drink and Hospitality, New Delhi	02 - 05 August 2005
5.	The Ninth National Expo - 2005, Kolkata, West Bengal	02 - 11 September 2005
6.	Agro Technology Week - 2005, Rahuri, Maharashtra	10 -14 October 2005
7.	*Raitu Sadassu*, Kakinada, Andhra Pradesh	24-25 October 05
8.	The Seventh Indian Fisheries Forum, Bangalore	08 - 12 November 2005
9.	*Rajyastariya Pasu Pradarshni*, Jhajjar, Haryana	17 - 18 November 2005
10.	Science Expo - 2005, Mumbai, Maharashtra	23 - 27 November 2005
11.	*Krishi* 2005, Nashik, Maharashtra	30 November 2005 – 05 December 2005
12.	*Kisan* 2005, Pune, Maharashtra	14 - 18 December 2005
13.	Workshop on Fisheries and Aquaculture, Ludhaina, Punjab	21 - 22 December 2005
14.	*Krishi Mela* - 2006, Jhabua, Madhya Pradesh	30 January – 1 February 2006
15.	Sustainability of Seafood Production, Goa	23 - 24 February 2006
16.	Agri Expo - 2006, Samastipur, Bihar	02 - 05 March 2006
17.	Krishi Expo - 2006, New Delhi	08 - 12 March 2006
18.	National Seminar and Fair on Ornamental Fish, Kolkata, West Bengal	17 - 18 March 2006
19.	Pusa *Krishi Vigyan Mela*, New Delhi	24 - 26 February 2006

6.3 Television Programmes

A team of Bhopal Doordarshan visited the Powarkheda Centre twice in the months of May and June 2005, and recorded the talk on carp seed production and culture for their regular telecast under *Krishi Darshan* Programme.

The Delhi Doordarshan prepared a documentary on the various activities of the Rohtak Centre on 03 June 2005, which was telecast on two occasions in the National Channel.

The Powarkheda Centre participated in a live television question-answer interactive programme with farmers on 19 August 2005.

Dr. C. S. Purushothaman gave an interview to the journalists of NDTV on 14 October 2005 regarding the mass fish-kill in the coastal waters of Mumbai.

Powarkheda Centre participated in *Fasal Sangosthi* Programme of Prasar Bharati Corporation, Doordarshan Kendra, Bhopal on 21 October 2005. This programme was also telecast by National Doordarshan, Delhi.

Dr. C. S. Purushothaman gave an interview to the Times of India TV on 21 October 2005 regarding the mass fish-kill in the coastal waters of Mumbai.

Three television programmes on magur: breeding, hatchery and seed production techniques; Scylla serrata culture; and Macrobrachium rosenbergii culture were given by Dr G. Venugopal and staff of Kakinada Centre in E-TV Channel (Telugu) in *Annadata* and *Jai Kisan* programmes.

6.4 Radio Talk

Mr K. Radha Krishna Reddy, Technical Officer, delivered a talk on *Marpuchepala pempakamlo Sanketika melakuvalu* at All India Radio, Visakhapatnam, on 06 May 2005.

6.5 Print Media

Print media, *viz.*, *Dainik Jagran* and *Rashtriya Sahara* published interviews of Dr. A. K. Jain, Officer-in-Charge, Lucknow Centre on various aspects of fisheries and the declining fishery of River Gomti due to increasing sewage pollution.

6.6 Technical Guidance and Fisheries Advisory services

Technical guidance was extended to two entrepreneurs of Madh Island, Mumbai, on Scientific Drying and Packaging of Fish for two weeks from 16 August 2005. After the training, these entrepreneurs are drying and exporting fish to Sri Lanka, and established a brand name in that country. They exported 50 t of dry fish to Sri Lanka during September-December 2005 under the brand name of "Global" at a premium price. Recently, they have secured order from Taiwan where quality requirements for dry fish are higher than in Sri Lanka.

During the year, the following samples were received for disease diagnosis and suitable advice on disease control was given:

Date	Received from	Sample	Investigations done	Treatment suggested
11.11.05	Pancham Aquaculture Farms Ltd. Saphale	*Siganus vermiculatus*	Necropsy, parasitology	100% water exchange with vigorous aeration and 0.5% BKC treatment
28.11.05	Aquatic World, Mumbai	Live samples for health certification - *Barbus denisonii, Hara jordani, Botia striata, Channa bleheri,* hifin barb	External examination, necropsy	Apparently healthy, no parasites
13.12.05	R. K. Fish Farm, Mumbai	Live samples for health certification - guppy, molly, goldfish, angelfish	External examination, necropsy	Apparently healthy, no parasites
23.01.06	Samarth Fisheries, Bhivandi	*Clarias gariepinus*	Microscopic examination of ulcer for bacteria, antibiotic sensitivity test	Change of water, $KMnO_4$ treatment
27.01.06	More Nursery, Thane	Rohu, catla, mrigal, prawn	Necropsy, external examination	Change of water and $KMnO_4$ treatment
30.3.06	Fishorama, Mumbai	Neon tetra	Microbiological, external and necropsy examination	Dip treatment in 2.5% saline solution

Technical guidance on fish culture aspects has been rendered to the fish farmers Mr Rajkumar Ginnore, Harda; Mr C. S. Rathore, Dewas; Mr Rajesh Tiwari and Mr C. J. Singh, Hoshangabad; and students from ZARS (JNKV), Powarkheda, who visited the Powarkheda Centre.

Scientists of the Rohtak Centre visited the Agriculture Technology and Information Centre (ATIC) at Indian Agricultural Research Institute, New Delhi, on every Friday of the month and gave necessary inputs to the visiting farmers on various technologies of fish and prawn culture and breeding.

Technical guidance was extended on specific aspects of aquaculture by visiting the site. Regular rapport is being maintained with the farmers and shrimp/scampi hatchery operators.

S. no.	Guidance on	Farmer's addresses
1	Scampi hatchery	BTS Hatchery, Konapapapet, Andhra Pradesh
2	Scampi culture	Srinivas and Chandrasekher, Tallarevu; and T.Suryanarayana Reddy, Balabhadrapuram, Andhra Pradesh
3	*Chanos chanos* culture	I. Ganga Raju, Bhimavaram, Andhra Pradesh
4	Shrimp hatchery	Ravivarma Hatchery, Tanuku, Andhra Pradesh
5	Shrimp culture	Srinivasa Raju, Elurupadu; and Ravivarma and Sh Ravivarma, Korukullu, Andhra Pradesh
6	Carp culture	Pilla Satyanarayana, Eleswaram, Andhra Pradesh
7	Magur Hatchery	D. Ramaraju, Padmanabha Labs, Chennai, Tamil Nadu
8	*C. chanos* and *Mugil cephalus* culture	Amarnath, Kaikaluru; and K. Subba Rao, Eluru, Andhra Pradesh
9	Technical know-how on various aspects of fisheries	Ramesh Singh, Juhu Kurd; Ajay Singh and Ranvir Singh, Jind; Hakimuddin, Palwal; and Dig Vir, Rohtak; Haryana

Visit of the Hon'ble Deputy Chief Minister of Bihar

The Kakinada Centre coordinated the visit of the Hon'ble Deputy Chief Minister of Bihar **Mr Susheel Kumar Modi** during 09-10 January 2006 to the fish farms at Sriparru; fish sampling in culture tanks, fish harvesting and fish packing units in and around Kaikaluru; prawn farming at Akiveedu; and Sai Ram hatcheries at Pallivada for Jayanthi rohu breeding.

Mr Sushil Kumar Modi, the Hon'ble Deputy Chief Minister of Bihar, with farmers/traders and officials during the visit

6.7 Visit Coordination

One thousand six hundred and sixty-nine pupils from primary sections, undergraduates, post-graduates, fisheries graduates and others visited the headquarters on educational tours. They were appraised about the activities of the Institute. Kakinada and Rohtak Centres coordinated the visits of 191 and 128 visitors, respectively and appraised the activities.

Mumbai

S. no.	Category	Number
1.	Primary-school pupils	910
2.	Under-graduates	627
3.	Post-graduates	33
4.	Fisheries Graduates	78
5.	Trainees of CIFE Centres	09
6.	Others	12
	Total	**1669**

Kakinada Centre

S. no.	Type of visitors	Number of visitors
1.	B.Sc. students, PR Government College, Kakinada, Andhra Pradesh	30
2.	B.Sc Students Railway Degree College, Secunderabad, Andhra Pradesh	40
3.	M.Sc. (Aquaculture), Acharya Nagarjuna University, Guntur, Andhra Pradesh	15
4.	B.F.Sc. students, Acharya N. G. Ranga Agricultural University, Nellore, Andhra Pradesh	6
5.	Fish Farmers, Bihar	25
6.	Students of PR Government College, Kakinada, Andhra Pradesh	75
	Total	**191**

Rohtak Centre

S. no.	Type of visitors	Numbers
1.	Fish farmers	10
2.	B.Sc. III students, Government College, Narnaul, Haryana	28
3.	B.Sc. III students, Jat College, Rohtak, Haryana	51
4.	B.Sc. III students, Government College, Charkhi Dadri, Haryana	18
5.	B.Sc. III students, GVM College, Sonepat, Haryana	21
	Total	**128**

During this period, 204 letters were dispatched to the interested farmers, entrepreneurs, business, visitors, etc., under fisheries advisory services.

The Lucknow Centre extended fisheries advisory services to 25 farmers on various aspects of fish culture and related specific needs.

The Kakinada Centre rendered the advisory services to 71 fish/scampi/prawn/farmers during the period.

6.8 Transfer of Technology and Demonstrations

Demonstration of scampi with polyculture:

Scampi under polyculture was successfully carried out for the first time in Uttar Pradesh in a 0.4-ha pond at the fish farm of the Lucknow Centre as part of the extension project entitled 'Adaptive Radiation of Existing Pisciculture Technologies in Barabanki District through Multi-directional Approach'. The culture was demonstrated to the local farmers and cadres of state fisheries department. The results of the demonstration activity have impressed the state fisheries personnel and they are popularizing the same in the state on a commercial scale.

Demonstration of growth stunting of carp seed:

Spawn of catla, rohu, mrigal and silver carp was stocked in nursery ponds at the Lucknow Centre at a total stocking density of 20 million per hectare and hygienically maintained. The growth of fish seed was slow and it reached fingerling size belatedly. Thereafter, its growth was stunted. Thus, the stockable seed remained available throughout the year. This was demonstrated to the farmers and state fisheries officials. This method will help the farmers to choose the timing of emptying their water bodies by disposing off grow-out fishes so that maximum profit can be reaped. Due to the availability of appropriately-sized stockable seed throughout the year, the emptied water body can be re-stocked at any time of the year. On the other hand, the nurseries can be utilized throughout the year which otherwise would remain unutilized for a longer period after the disposal of fish seed.

Demonstration

A number of demonstrations were held at the Kakinada Centre's brackishwater and freshwater fish farms for the benefit of the visitors and to explain the research and farm activities.

Field Training

Two batches of trainees from Jammu and Kashmir, and participants of the short-term HRD training were imparted hands-on training in induced breeding, and hatchery, nursery and grow-out management.

The Kakinada Centre organized the following field training programmes in Andhra Pradesh:

S. no.	Venue	Duration
1.	Tallarevu	18 May 2005
2.	*Ryatu Sadassu*, Rajahmundry	28 May 2005
3.	*Ryatu Sadassu*, Kakinada	24 - 25 October 2005

6.9 Fish Farmers' Day

Fish farmers' day was organised on 8 July 2005 at CIFE, Mumbai and Dr S.D.Tripathi falicitated best farmers . Fish farmers' day was also celebrated at the Kakinada Centre on 9 July 2005; two progressive farmers identified from the East and West Godavari districts were felicitated. A total of 150 fish farmers from both the districts and fisheries officials attended the function.

Dr. S.D.Tripathi felicitating Mr. A.S.Patil, the best farmer

Dr. G. Venugopal presenting the Best Farmer certificates

Dr. S.D.Tripathi felicitating the best farmer from Andhra Pradesh

Hon'ble MLA, Anaparty, felicitating Sh. Mehar, the Best Farmer

Dr. S.D.Tripathi felicitating Mr. Manoj Sharma, the best farmer

Sh. Naveen Chand, IPS, Superintendent of Police, East Godavari District, felicitating Sh. Ch. Subbarayudu, the Best Farmer

Dr. G. Venugopal, Officer-in-Charge, Kakinada Centre, coordinated the visit of The Secretary of Fisheries, Government of Uttar Pradesh Mr Devendra Chowdary to West Godavari and Krishna districts of Andhra Pradesh on 10 February 2006 in association with the Department of Fisheries, Government of Andhra pradesh.

Extension Council Meeting

The Fourteenth Extension Council Meeting was held on 27 January 2006 at the headquarters. Dr. Dilip Kumar, Director, welcomed all the distinguished members of the newly constituted Extension Council of the Institute and stated that this is one of the most important councils of the Institute. The message from Dr. M. Vijaya Gupta, World Food Prize Laureate, and former Assistant Director General, World Fish Center, Malaysia, sent for this occasion was read out by the Director. Dr. Kumar further revealed the views of Dr. Gupta and said "unless the scientists work hand-in-hand with all those involved in the sector, understand their resources, needs and constraints, and then tailor their research to developmental needs, it would not be possible to make much progress".

Dr P. Das, Deputy Director General (Extension Education), Indian Council of Agricultural Research, New Delhi, opined that the research institutes should demonstrate the transfer of know-how in field situations. CIFE may take up two proposals to develop mechanisms on experimental basis for developing suitable strategies for capture and culture fisheries. Dr. D. P. S. Chauhan, Deputy Commissioner (Fisheries), Government of India, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, New Delhi, stated that fisheries is a state subject and the role of CIFE is supplementary.

The theme area for Fisheries Extension, as proposed by the Director stands as "Strengthening fisheries extension services through developing appropriate and location-specific strategies and approaches through community participation in capture and culture fisheries".

XIV Extension Council Meeting

7 Honours and awards

Best Thesis Award

Dr. Dilip Jalihal Endowment Award for the Best Thesis was received by Ms Dharitri Choudhury for her outstanding master degree research work in

fisheries and allied sciences on "Effect of Dietary Immunonutrients on Growth and Survival of *Labeo rohita* Fingerlings" under the guidance of Dr A. K. Pal, Principal Scientist.

Best Poster Presentation Award

The Best Poster Presentation Award was received by Ms Sona Yengkokpam from the Asian Fisheries

Society, Indian Branch, at the 7th Indian Fisheries Forum held during 08-12 November 2005 at Bangalore for the poster entitled "Gelatinized Carbohydrates in the Diet of *Catla catla* Fingerling: Effect of Levels and Sources on Nutrient Utilization, Body Composition and Tissue Enzyme Activity" by Yengkokpam, S., Sahu, N. P., Pal, A. K., Mukherjee, S. C. and Debhnath, D.

Young Scientist Award

Dr S. M. Manush received the Young Scientist Award - 2005 for the research paper entitled "Acclimation Temperature Influences

Regeneration of Ablated Claws in *Macrobrachium rosenbergii*" by Manush, S. M., Pal, A. K. and Mukherjee S. C., from the Asian Fisheries Society, Indian Branch, at the 7th Indian Fisheries Forum held during 08-12 November 2005 at Bangalore.

Other Awards/Prizes

Ms Sunitha Ninan received the Consolation Prize from the Professional Fisheries Graduates Forum, Mumbai, for her M.F.Sc. dissertation entitled "Stakeholder's Perception on Impact of Patenting in Fisheries Sector".

Ms Divya Alice Varkey, M.F.Sc. (FRM) Student, was selected for a short training to Singapore during August 2005 as part of Hiralal Chaudhary Endowment Scholarship for scoring the highest marks in M.F.Sc.

Mr Dipesh Debnath, Ph.D. Student, visited the Danish Institute of Fisheries Science, Lyngby, on a

short-term training programme for being the overall topper in the Ph.D. course work under the Tata Endowment Overseas Research Scholarship Scheme.

Dr K. Pani Prasad received the Best Young Scientist Award for the year 2006 from the Bioved Research and Communication Centre, Allahabad.

Dr Sanjay Jadhao received the Best Citizen of India Award - 2005 from Best Citizen Publishing House, New Delhi.

Dr Sanjay Jadhao received Vijayshree Award from India-International Friendship Society, New Delhi, for the year 2005.

Fellowships Conferred

Dr S. D. Singh has been awarded the Fellowship of Bioved Research Society, Allahabad, 2006.

Dr A. K. Pal has been awarded the Fellowship of National Academy of Veterinary Sciences.

Dr Aparna Choudhary received the Fellowship Award 2005 from Bioved Research and Communication Centre, Allahabad.

Awards for Work in Hindi

CIFE received the Chal Vaijayanti Shield - 2005 and Aashirwad Rajbhasha Samman for the contributions in the field of Hindi from Aashirwad, a reputed Social and Cultural Organisation based at Mumbai.

CIFE bagged for the third time the Rajarshee Tondon Award constituted by ICAR for promoting Hindi for the year of 2004-05.

Mr R. P. Uniyal, Assistant Director (Official Language), received the Shri Jagdish Gupt Award from Vishwa Sneh Sammelan, Allahabad. He also received Tri Rajya Gaurav Award – 2005 and Hindi Sahitya Samman – 2005.

ICAR Zonal Sports Tournament

CIFE sports team participated in the ICAR Zonal Sports Tournament held at the Central Arid Zone Research Institute, Jodhpur, during 01-05 February 2006 and Ms Vandana Tambe, S. S. Gr. II, won the following prizes:

100-m running race	First prize
200-m running race	First Prize
High jump	First Prize

She also bagged the Best Athlete Award (Woman) of the tournament.

8 Linkages and collaboration

The institute maintains linkages with various national and international institutions and agencies for educational, research and developmental collaborations.

International institutions
- International Ocean Institute, Malta
- WorldFish Center, Penang, Malaysia
- Food and Agriculture Organization of the United Nations, Rome, Italy
- Australian Centre for International Agricultural Research, Australia
- Norwegian Agency for International Cooperation, Norway

Government of India Organisations
- Integrated Fisheries Project, Kochi
- Central Institute of Coastal Engineering for Fishery, Bangalore
- Central Institute of Fisheries Nautical and Engineering Training, Kochi
- Fishery Survey of India, Mumbai
- Marine Products Export Development Authority, Kochi
- National Remote Sensing Agency, Hyderabad
- Indian Institute of Technology, Kharagpur
- Indian Institute of Technology, Chennai
- Indian Institute of Science, Bangalore
- National Institute of Nutrition, Hyderabad
- Zoological Survey of India, Kolkata
- Department of Ocean Development, Government of India
- Department of Science and Technology, Government of India
- Department of Biotechnology, Government of India

ICAR Institutes
- Central Marine Fisheries Research Institute, Kochi
- Central Institute of Brackishwater Aquaculture, Chennai
- Central Institute of Freshwater Aquaculture, Bhubaneswar
- Central Inland Fisheries Research Institute, Barrackpore
- Central Institute of Fisheries Technology, Kochi

CSIR Institutes
- Industrial Toxicology Research Centre, Lucknow
- Central Drug Research Institute, Lucknow
- Central Institute of Medicinal and Aromatic Plants, Lucknow
- Central Food Technological Research Institute, Mysore
- National Institute of Oceanography, Goa
- Centre for Cellular and Molecular Biology, Hyderabad

Universities
- Cochin University of Science and Technology, Kochi
- Annamalai University, Chidambaram
- University of Goa, Goa
- Acharya N. G. Ranga Agricultural University, Hyderabad
- Andhra University, Visakhapatnam
- Acharya Nagarjuna University, Guntur
- Awadesh Prathap Singh University, Rewa

State Governments
- Department of Fisheries, Government of Haryana
- Department of Fisheries, Government of Uttar Pradesh
- Department of Fisheries, Government of Bihar
- Department of Fisheries, Government of Tamil Nadu
- Department of Fisheries, Government of Andhra Pradesh
- State Institute of Fisheries Technology, Kakinada

Other Organisations
- Tata Power Company, Mumbai
- Action Aid International, Port Blair
- M. S. Swaminathan Research Foundation, Chennai

9 Publications

9.1. Research Publications in Refereed Journals

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10 Consultancy, patents and commercialisation of technology

The Rohtak Centre of CIFE offered consultancy services for a sum of Rs 60,000 to the Department of Fisheries, Government of Haryana on prawn farming. The consultancy service on identifying the shortfalls in the survival and the targeted production of prawn during the year 2004 from the farmers' ponds in four districts (Rohtak, Jind, Bhiwani and Jhajjar) were offered. Accordingly, Dr S. Raizada, Senior Scientist at the centre, and Dr A. K. Reddy, Technical Officer at the headquarters, surveyed 31 prawn-farming sites and identified the problems faced by the farmers. They submitted a detailed report to the department. The centre further assisted the department in conducting the stocking programme for the year 2005 for which the scientists of the centre participated in several awareness camps at district level and personally visited the prawn-farming sites to give the necessary inputs to the farmers.

11 Participation of faculty in conferences, meetings, training programmes, etc.in India and abroad

The faculty of the institute participated in the following events during the year under report:

11.1 Workshops/Seminar/Conferences/Congresses

S. no.	Programme	Period	Venue/Organized by	Participant(s)
1.	Seminar on Riverine Ecosystem and Conservation	16 April 2005	Central Inland Fisheries Research Institute, Kolkata	P. K. Ghosh
2.	Workshop on Aquaculture - Options and Opportunities	24-25 April 2005	Thakur College, Mumbai	A. K. Reddy
3.	National Symposium on Reassessment of Fish Genetic Resources in India and Need to evolve Sustainable Methodology for Conservation	25-26 April 2005	National Bureau of Fish Genetic Resources, Lucknow	A. K. Jain
4.	National Seminar on Food Quality and Safety Standards of Agricultural Raw and Processed Produce	26-27 April 2005	National Agriculture Science Complex, New Delhi	S. Basu
5.	Workshop on Fish Distribution System in Coastal Communities: Credit and Market Access Issues in Coastal Maharashtra	29-30 April 2005	Central Institute of Fisheries Education, Mumbai	C. S. Purushothaman
6.	Planning Workshop on Fisheries Stock Assessment Capacity Building	09-13 May 2005	Department of Fisheries, Government of Andhra Pradesh, Visakhapatnam	R. S. Biradar
7.	Seminar on Fish Processing (Handling and Packaging), Value Addition and Marketing of Product	03-04 June 2005	Agriculture Technology Management Agency, Muzaffarpur	S. Basu
8.	Workshop on Establishing Food Safety Systems in Small and Medium Enterprises in India	08 June 2005	Hotel Orchid, Mumbai	S. Basu
9.	Workshop on Organic Aquaculture	14 June 2005	Marine Products Export Development Authority, Kolkata	A. Sinha, S. Datta, P. Sardar

10.	Workshop on How to Increase Survival of Eggs and Spawn in Indian Major Carp Hatcheries	17 June 2005	Aquaculture Research and Training Institute, Hisar	S. Raizada
11.	25th Annual ESRI International User Conference and 5th Annual ESRI Education User Conference	23-29 July 2005	San Diego Convention Center, San Diego, USA	M. Pikle
12.	Training Workshop on Participatory Fisheries Stock Assessment	25-29 July 2005	College of Fisheries, Mangalore	R. S. Biradar
13.	Planning Workshop on Stock Assessment Tools	08-12 August 2005	Department of Fisheries, Government of West Bengal, Kolkata	R. S. Biradar
14.	Seminar on High Performance Liquid Chromatography	18 August 2005	Waters India Ltd., Kolkata	P. Sardar
15.	National Workshop on Assessment of Current and Futurist Water Quality Standards in India	20-21 September 2005	Central Glass and Ceramic Research Institute, Kolkata	K. Chandra
16.	Seminar on Thermal Analysis	04 October 2005	Waters India Ltd, Kolkata	S. Datta
17.	Workshop on Brackishwater Shrimp Farming - Problems and Solutions	23 October 2005	Association of Technical Staff & Fisheries Professionals of College of Fisheries, Ratnagiri	A. K. Reddy
18.	National Seminar on *Uttaranchal mein Matsyiki ki Bhavi Sambhavanayem*	28-29 October 2005	Hemwati Nandan Bahuguna Garhwal University, Srinagar (Uttaranchal)	Dilip Kumar, C. S. Purushothaman, S. D. Singh, A. Sinha, A. K. Jain, K. Chandra, P.M. Sherry, V. K. Tiwari, C. S. Chaturvedi, R. P. Uniyal, P. K. Das, R. Dhongde
19.	Third Indian Fisheries Science congress	04-06 November 2004	Indian Society of Fisheries Professionals, New Delhi	Gopal Krishna, A. Choudhari, S. S. Jahageerdar
20.	7th Indian Fisheries Forum	08-12 November 2005	Hebbal Campus of Karnataka Veterinary, Animal and Fishery Sciences University, Bangalore	Dilip Kumar, C. S. Purushothaman, S. D. Singh, G. Venugopal, S. Raizada, G. Venkateshwarlu, P K. Pandey, S. Datta, A. Sinha, P. Sardar, A. Sharma, P. S. Ananthan, G. Deshmukhe, A. Dwivedi, M. Ali

21	NAARI Conference on Radioisotopes and Radiation Technology – User's Perception and Experience	10-11 November 2005	Bhabha Atomic Research Centre, Mumbai	S. Basu, B. B. Nayak
22	National Seminar on Developments in Limnology and Biodiversity Studies on Zooplankton	10-12 November 2005	Acharya Nagarjuna University, Nagarjuna Nagar	V. N. Acharyulu
23	National Workshop on Freshwater Prawn Farming	25 November 2005	Marine Products Export Development Authority, Pune	A. K. Reddy
24	National Workshop on Culture of Catfishes and Murrels in Haryana	25-26 November 2005	Department of Fisheries, Government of Haryana, Chandigarh	U. K. Maheshwari, S. Raizada
25	25th International Cartographic Conference 2005	28-30 November 2005	Sagar University, Sagar	R. Singh
26	Hindi Seminar	09 December 2005	Central Institute of Fisheries Technology, Kochi	Dilip Kumar, C. S. Purushothaman
27	National Conference - Micro Biotech 2005	08-10 December 2005	Osmania University, Hyderabad	G. Venugopal
28	National Seminar on Aquaculture Biotechnology	17-18 December 2005	Acharya Nagarjuna University, Nagarjuna Nagar	G. Venugopal
29	Conference on Fisheries and Aquaculture in Indus River Region - Conservation, Management and Development of Indigenous Fish Fauna	21-22 December 2005	Punjab Agricultural University, Ludhiana	N. K. Chadha, C. Prakash
30	National Seminar on Current Trends in Fishery Science Research	21-22 January 2006	NES College, Nanded	A. K. Reddy
31	Workshop on Intensive Training in Hindi	02-04 February 2006	National Academy of Agricultural Research Management, Hyderabad	K. Biswas
32	National Workshop on Post-harvest Methods and Domestic Fish Marketing Opportunities, Technology and Marketing Strategies	03-04 February 2006	State Institute of Fisheries Technology, Kakinada	S. Basu, G. Venugopal

33.	National Workshop on Recent Advances in Biosciences in Bio-Meet 2006	10-11 February 2006	GVM College, Sonepat	N. K. Chadha
34.	Workshop on Freshwater Prawn Farming in Uttar Pradesh	11-12 February 2006	Department of Fisheries, Government of Uttar Pradesh	S. Raizada
35.	National Conference on Aquatic Resources, Aquaculture and Aqua Show	15-17 February 2006	St. Xavier's College, Palayamkottai	G. Venugopal
36.	International Conference on Social Science Perspectives in Agricultural Research and Development	15-18 February 2006	International Society for Ecological Economics, New Delhi	S. N. Ojha, A. Sharma
37.	Regional Seminar on Emerging Scenario of Patents' Protection, Valuation & Commercialization	16 February 2006	Institute of Bioresources and Sustainable Development, Imphal	S. Datta
38.	7th Indian Agricultural Science Congress	16-18 February 2005	College of Agriculture, Pune	S. D. Singh
39.	8th Indian Agricultural Scientists' & Farmers' Congress	21-22 February 2006	Banaras Hindu University, Varanasi	S. D. Singh
40.	Symposium on RNAi and MicroRNA in Health and Development	23-24 February 2006	Centre for Cellular and Molecular Biology, Hyderabad	Gopal Krishsna, A. Choudhari, S. S. Jahageerdar
41.	Seminar on Current Trends in Drinking Water and Wastewater Analysis	24 February 2006	E-Merck (India) Ltd, Kolkata	S. Datta
42.	National Seminar on Marine and Estuarine Biodiversity	26-27 February 2006	Central Calcutta Science and Culture Organization for Youth, Kolkata	A. Sinha
43.	National Workshop on Ornamental Fish Breeding, Rearing & Management	07-08 March 2006	Vidyasagar University, Midnapore	R. C. Das
44.	Shrimp Farmers' meet-cum-HACCP Workshop	23 March 2006	Central Institute of Fisheries Education, Mumbai	C. S.Purushothaman, S. Basu, B. B. Nayak
45.	National Convention on Knowledge-driven Agricultural Development: Management of	24-26 March 2006	Agricultural Research Service Scientists' Forum, New Delhi	S. Jadhao, A. Choudhari

11.2 Training programmes/Summer schools/Winter schools

S. no.	Programme	Period	Venue/Organized by	Participant(s)
1.	Animal Breeding (Quantitative Genetics - MAS, Linkage Analysis, and Use of Software and Statistical Package in Breeding Data Analysis)	14 March -14 May 2005	Institute of Aquaculture Research, Norway	Gopal Krishna, S. S. Jahageerdar
2.	Development of High-end Resource Materials for Effective Teaching and Learning	28 April - 18 May 2005	National Academy of Agricultural Research Management, Hyderabad	D. Bhoomaiah
3.	Geomedia Grid and Terrain Models	27-29 June 2005	M/s Rolta India Ltd, Mumbai	R. Singh, R. H. Khandagale
4.	Summer School on Management Issues in Fisheries and Bio-diversity of Estuarine and Associated Ecosystems	21 July – 10 August 2005	Central Inland Fisheries Research Institute, Kolkata	V. K. Tiwari
5.	Fisheries Stock Assessment using the FMSP Tools and Management of Fishery for Writing and Implementing a Fishery Management Plan	August 2005 (Five days)	Department of International Development, Kolkata	K. Chandra
6.	Digital Imaging	05-14 September 2005	Central Institute of Fisheries Education, Mumbai	P. S. Ananthan
7.	Communication Skills and Technical Writing	07-27 September 2005	Chaudhary Charan Singh Haryana Agriculture University, Hisar	Ashok Kumar
8.	Summer School in Aquatic Microbiology with Reference to Aquaculture	21 September - 11 October 2005	Central Institute of Fisheries Education, Mumbai	K. Pani Prasad, B. B. Nayak
9.	Strategies Towards Improvement of Industrial Microorganisms for Metabolite Products	24-28 October 2005	Central Food Technology Research Institute, Mysore	P. K. Pandey
10.	Winter School on Advances in Engineering and Agronomic Interventions for Declining Water	07-26 November 2005	Central Soil salinity Research Institute, Karnal	A. K. Verma

11.	Advances in Disease Diagnostics for Finfish and Shellfish Health Management	15 November - 05 December 2005	Central Institute of Fisheries Education, Mumbai	N. K. Chadha
12	Human Resource Strategy for Agricultural Research Organization	13-23 December 2005	National Academy of Agricultural Research Management, Hyderabad	U. K. Maheshwari
13	Training Programme on Effective Office Administration	16-20 December 2005	National Institute of Management and Advancement, Shimla	J. Singh
14	National Training Programme on Microbial Diversity Analysis of Agriculturally Important Microorganisms	03-25 January 2006	National Bureau of Agriculturally Important Microorganisms, Mau	A. Vennila
15	Intellectual Property Management and Technology Transfer	05-11 February 2006	University of Pune, Pune	P. S. Ananthan
16	Integrating IPR Culture with R&D	15 February 2006	Institute of Bioresources and Sustainable Development, Imphal	S. Datta
17	Computer-based Multimedia Presentation	16 February - 08 March 2006	National Academy of Agricultural Research Management, Hyderabad	P. S. Ananthan P. Sardar
18	Management Development Programme on Finance for Non-finance Executives	20-24 February 2006	National Institute of Financial Management, Faridabad	S. K. Pandey
19	Management Development Programme on Performance Assessment of Agricultural Research Organisations	22-28 February 2006	National Academy of Agricultural Research Management, Hyderabad	C. S. Purushothaman

11.3 Brainstroming sessions/Awareness camps/Farmers' meet

S. no.	Brainstorming Session	Period	Venue/Organized by	Participant(s)
1.	Brainstorming Session on Development of Processing and Value Addition in Freshwater Fishes	25 April 2005	G. B. Pant University of Agriculture and Technology, Pantnagar	S. Basu
2.	Identifying Strategic Issues and Perspective Approaches in Higher Agricultural Education System in India to face Challenges of GATS	26 August 2005	Central Institute of Fisheries Education, Mumbai	R. S. Biradar, S. N. Ojha, L. Shenoy, B. B. Nayak, A. Sharma, P. S. Ananthan
3.	Awareness Programme on Conservation of Lobsters in Maharashtra	28 November 2005	Central Institute of Fisheries Education, Mumbai	C. S. Purushothaman, A. Sharma
4.	Hindi *Sammelan*	28-30 December 2005	Rajbhasha Sansthan, Pondichery	R. P. Uniyal
5.	Western Zone Town Official Language Implementation Committee *Sammelan*	08-09 January 2006	Gujrat Refinery Township, Vadodara	R. P. Uniyal, P. K. Das
6.	Water Budgeting	27 January 2006	CIFE, Mumbai	R. S. Biradar, C. S. Purushothaman, S. N. Ojha, L. Shenoy, A. Sharma, P. S. Ananthan
7.	Brainstorming Session on Fisheries Resources Conservation	28 January 2006	National Bureau of Fish Genetics Resources, Lucknow	A. K. Jain, A. K. Reddy
8.	Disaster Management in Fisheries and Aquaculture	30 January - 03 February 2006	National Institute of Disaster Management, New Delhi	R. S. Biradar, G. Venkateshwarlu, A. Sharma,
9.	Farmers' Meet on Brackishwater Aquaculture	23 February 2006	ICAR Complex, Goa	A. K. Reddy
10.	Brainstorming Session on Fisheries Education and Training	28 February 2006	Central Institute of Fisheries Education, Mumbai	S. Basu, A. K. Reddy

12 Workshops, seminars, summer institutes, meetings, *etc*. organised

12.1 Meetings

S. no.	Meeting	Period
1.	Staff Research Council	18-20 April 2005, 06 December 2005
2.	Board of Examinations	20 May 2005, 23 November 2005, 04 March 2006
3.	Town Official Language Implementation Committee (North Mumbai)	29 November 2005
4.	Academic Council	16 December 2005
5.	Board of Management	30 December 2005
6.	Research Advisory Committee	03 January 2006
7.	Quinquennial Review Team	06 January 2006
8.	Extension Council	27 January 2006

12.2 Conferences/Symposia/Workshops/Seminars/Brainstorming Sessions/Awareness Camps

S. no.	Programme	Venue	Period
1	Awareness Camp on Prawn Farming in Haryana	Rohtak	10 June 2005
2	Workshop-cum-Training for In-service Trainers	Lucknow	05 July 2005
3	Brainstorming Session on GATS and Strategic Issues in Higher Agricultural Education - Fishery Science & Technology	Central Institue of Fisheries Education, Mumbai	26 August 2005
4	National Seminar on *Uttaranchal mein Matsiki ki Bhavi Sambhavnayen*	Hemvati Nandan Bahuguna Gadwal University, Srinagar (Uttaranchal)	28-29 October 2005
5	Hindi Computer Workshop	Central Institue of Fisheries Education, Mumbai	17 December 2005
6	Conference on Fisheries and Aquaculture in Indus River System: Conservation, Development and Management of Indigenous Fish Sources	Punjab Agricultural University, Ludhiana	21-22 December 2005
7	Hindi Workshop	Central Institue of Fisheries Education, Mumbai	13 July 2005
8	Farmer's Workshop on Prawn Culture	Lucknow	01-12 February 2006
9	Shrimp Farmer's Meet-cum-HACCP Workshop	Central Institue of Fisheries Education, Mumbai	23 March 2006

Hands-on training to the participants of summer school

Shrimp farmers' meet-cum-HACCP workshop

12.3 CAS Programmes

S. no.	Programme	Period
1	Advances in Disease Diagnostics for Finfish and Shellfish Health Management	15 November – 05 December 2005
2	Recent Advances in Biochemical and Molecular Techniques and their Applications in Aquaculture	28 March – 17 April 2006

12.4 Summer/Winter School

S. no.	Programme	Period
1.	Summer School on Aquatic Microbiology with Reference to Aquaculture	21 September -11 October 2005

12.5 Others

S. no.	Programme	Period
	Interactive Session with Aqua-farmers at Barabanki	24 June 2005
	Fish Farmer's Day	08 July 2005
	Farmers' Interactive Meet at Mathura on Freshwater Giant Prawn Farming	05 September 2005
	Hindi Pakhwada	14-29 September 2005
	Annual Day	25 June 2005

13 Distinguished visitors

Headquarters

Mr Sharad Pawar	Hon'ble Union Minister of Agriculture and Cooperation, Govt. of India
Dr Mangala Rai	Secretary, Department of Agricultural Research and Education (Government of India) and Director General, Indian Council of Agricultural Reseach, New Delhi
Dr S. Ayyappan	Deputy Director General (Fisheries), I.C.A.R., New Delhi
Dr M. D. Zingde	Scientist In-charge, National Institute of Oceanography, Regional Centre, Mumbai
Dr S. Sreenivasan	Director, Central Institute for Research in Cotton Technology, Mumbai
Dr V. R. Somvanshi	Director General, Fisheries Survey of India, Mumbai
Dr H. R. Singh	Vice-Chancellor, Rajendra Agricultural University, Pusa, Samastipur
Dr Lalji Singh	Director, Centre for Cellular and Molecular Biology, Hyderabad
Dr Bruce Phillips	Curtin University of Technology, Perth, Australia
Dr Ravi Fotedar	Curtin University of Technology, Perth, Australia
Dr S. L. Mehta	Vice-Chancellor, Maharana Pratap University of Agriculture and Technology, Udaipur
Dr M. V. Gupta	Assistant Director General (International Relations and Partnerships), International Network on Genetics in Aquaculture, World Fish Centre, Penang, Malaysia

Powarkheda Centre

Mr F. A. Kidwai,IAS	Collector, Hoshangabad

Kakinada Centre

Mr Sundar Kumar	Commissioner of Fisheries, Government of Andhra Pradesh, Hyderabad
Mr Sudersan Swamy	President, All India Shrimp Hatcheries Association, Visakhapatnam
Mr V. Naveen Chand	IPS, Superintendent of Police, East Godavari District
Ms K. Saroja	Mayor, Municipal Corporation of Kakinada
Mr A. Saha	Project-in-Charge, Reliance Energy (P) Ltd, Samalkot
Mr S. Reddy	Deputy Director (Fisheries), Government of Andhra Pradesh, Kakinada
Mr R. G. Rao	Principal, State Institute of Fisheries Technology, Kakinada

Rohtak Centre

Dr S. C. Agarwal	Director of Fisheries, Government of Haryana, Chandigarh
Dr A. D. Diwan	Assistant Director General (Marine Fisheries), I.C.A.R., New Delhi
Dr Stewart Fielder	Scientific Officer and Project Leader (ACIAR-ICAR Project), Port Stephens, Australia
Dr S. L. Madan	Former Vice-Chancellor, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
Dr D. N. Jha	Former Director & ICAR National Professor, National Centre for Agricultural Economics & Policy Research, New Delhi
Prof. S. K. Garg	Department of Zoology and Biosciences, C.C.S. Haryana Agricultural University, Hisar

Lucknow Centre

Mr Devendra Chaudhary	Secretary, Department of Fisheries, Government of Uttar Pradesh, Lucknow
Mr P. R. Mishra	Director, Department of Fisheries, Government of Uttar Pradesh, Lucknow
Mr A. K. Tandon	Special Secretary, Department of Fisheries, Government of Uttar Pradesh, Lucknow
Dr S. C. Pathak	Former Chief General Manager, NABARD, Mumbai
Dr W. S. Lakra	Director, National Bureau of Fish Genetic Resources, Lucknow
Dr Lindsay Furwess	Project Consultant, Australia

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Mr R. Singh

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Mr R. D. Deshmukh
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Mr V. K. Bhave
Mr M. Baqar
Ms S. Iftekhar
Mr K. D. Raju

Administration and Finance
Chief Administrative Officer
Mr Chironji Lal

Senior Administrative Officer
Mr Suresh Kumar (till 08.09.2005)

Finance & Accounts Officers
Mr Prem Shankar (till 06.06.2005)
Mr G. C. Prasad (from 06.06.2005)

Administrative Officer
Mr P. D. Sonawane (retired on 27.02.2006)

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Mr R. P. Uniyal

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Mr T. D. Kumar
Ms V. Pavithran
Mr S. S. Kocharekar
Ms T. Padmavathi

Private Secretaries
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Ms D. S. Naik

Upper Division Clerks
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Ms F. G. Fernandes
Ms C. S. Khundol
Mr D. S. Ingale
Mr R. R. Kadam
Mr R. G. Gamare
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Ms V. Tambe
Ms K. R. Ahire
Mr T. G. Gaikwad
Mr J. K. Makwana
Mr A. R. Dore
Mr B. R. Chavan
Mr M. P. Kotian
Mr G. B. Kamble
Mr A. R. Shingade
Mr J. N. Dhanu
Mr V. N. Ondkar

Grade I
Mr S. P. Malvankar
Ms R. H. Chavan
Mr R. N. Kamble
Ms S. J. Kolambkar
Mr G. N. Zendekar
Mr A. N. Joyashi
Mr A. D. Sonawane

Vessel Staff
Skipper (T-7)
Mr K. Satyanarayana

Engineer FTV (T-8)
Mr J. Jacob

Engine Driver (T-5)
Mr S. K. Chodankar

Additional Engine Driver (T-6)
Mr S. L. Kotian

Mate (T-4)
Mr S. Maity

Deckhands (T-2)
Mr K. V. Rajendran
Mr S. L. Mungekar
Mr A. P. Dhawde

Cook
Mr S. Kamaraju

Supporting Staff
Grade IV
Mr B. N. Sukur
Mr A. Bijali

Grade III
Mr G. G. Zendekar
Mr V. Patil
Mr S.Padyal

Grade I
Mr A. Lavande

Rohtak Centre

Principal Scientist
Dr U. K. Maheshwari (Officer In-charge)

Senior Scientists
Dr S. Raizada
Dr N. K. Chadha

Scientist
Mr A. K. Verma

Technical Staff
T-7
Dr M. Aii

T-6
Mr I. Singh

T-4
Mr Ashok Kumar

T-3
Mr H. Javed
Mr S. K. Singh

T-1
Mr Krishan Kumar

Administrative Staff
Upper Division Clerk
Mr V. K. Sinha

Supporting Staff
Grade I
Mr Gyani Ram
Mr Gyan Chand
Mr Lavesh Kumar

Powarkheda Centre

Senior Scientist
Dr Somdutt (Officer-in-Charge)

Scientist (Selection Grade)
Mr S. S. H. Razvi

Technical Staff
T-6
Mr R. K Upadhyay

T-5
Mr V. G. Dubey

T-4
Mr L. P. Bamalia

T-II-3
Mr G. Singh

T-1
Mr A. Singh

Administrative Staff
Assistant
Ms A. Dhurve

Supporting Staff
Grade III
Mr H. M. Potpose
Mr H. Singh
Mr L. Prasad
Mr Vishnulal

Grade II
Mr M. Prasad
Mr Surendra Kumar
Mr R. K. Prasad
Mr R. Swaroop
Mr Manoharlal
Mr S. Dayal
Mr S. Prajapati

Lucknow Centre

Senior Scientists
Dr Alok K. Jain
(Officer-in-Charge)
Dr P. K. Varshney
Dr P. M. Sherry

Technical Staff
T-6
Dr (Ms) Z. Jaffar

T-5
Mr S. P. Singh
Mr A. K. Yadav
Mr P. Satyanarayana

T-4
Mr S. K. Upadhyay
Mr M. Gyas

T-3
Mr Ravi Kumar
Mr S. K. Singh
Mr A. S. Bisht

T-1
Mr Om Prakash
Mr P. C. Jaiswar
Mr R. Bharose

Administrative Staff
Assistants
Mr Pooranchand (retired on 29.12.2005)
Mr J. Singh

Upper Division Clerk
Mr P. K. Awasthi

Lower Division Clerks
Mr P. C. Verma
Mr Sajeevan Lal

Supporting Staff
Grade IV
Mr Narayan

Grade II
Ms. K. Jai Kishore
Mr R. L. Nishad

Grade I
Mr K. Dush Raj
Mr Suneet Kumar
Mr Anwar
Mr J. N. Tiwari
Mr Mahesh Chand

Cook
Mr Vinod Kumar

Kakinada Centre

Principal Scientist
Dr G. Venugopal (Officer-in-Charge)

Technical Staff
T-7/8
Mr P. S. Rao

T-6
Mr K. B. S. Murthy
Mr P. R. Reddy
Mr J. Krishna Prasad
Mr K. Murali Mohan

T-5
Mr V. N. Acharyulu
Mr K. R. K. Reddy
Mr R. R. S. Patnaik
Mr B. K. Rao

T-I-3
Mr S. S. Murthy (retired on 31.07.2005)

T-2
Mr Y. S. Murthy
Mr M. Satyanarayana

T-1
Mr A. Gurayya
Mr K. Mallaiah

Administrative Staff
Assistants
Mr P. V. G. K. Murthy
Mr B. Veera Raju

Upper Division Clerk
Mr B. L. Rao

Lower Division Clerk
Ms M. Rama Mani

Supporting Staff
Grade IV
Mr K. Pothu Raju
Mr M. H. Reddy
Mr M. Krishna
Mr S. Kale
Mr M. Ch. A. Rao

Grade II
Mr K. Satyanarayana
Mr S. N. Saheb
Mr K. Niranjan

Grade I
Mr N. Venkata Ramana
Mr K. Prasad
Mr V. Shivaji
Mr O. Veeraraju
Mr K. Dharma Raju
Mr T. Satyanarayana
Mr P. V. K. Reddy
Mr P. D. Reddy
Mr S. Valisha
Mr A. L. Reddy
Mr S. S. Reddy
Mr Y. Butchilingam
Mr M. Govindu
Mr A. Anandu
Mr G. V. V. Satyanarayana
Mr M. A. Rao

Kolkata Centre

Principal Scientists
Dr R. C. Das (Officer-in-Charge)
Dr P. K. Ghosh
Dr Krishna Chandra

Senior Scientist
Dr (Ms) A. Sinha

Scientists (Selection Grade)
Mr P. K. Roy
Mr B.N. Tiwari

Scientists (Senior Scale)
Dr S. Datta
Dr P. Sardar

Technical Staff
T-5
Mr P. S. Pandey
Mr S. K. Sharma
Mr R. K. Biswas (retired on 28.02.2006)
Mr A. K. Mandal (retired on 31.10.2005)

T-1-3
Mr R. K. Mandal
Mr P. K. Patra
Mr S. K. Das

T-1
Mr T. K. Ghosh

Administrative Staff
Stenographer
Ms K. Biswas

Upper Division Clerk
Mr C. N. Sahani

Lower Division Clerks
Mr P. K. De
Mr R. M. Singh

Supporting Staff
Grade IV
Mr B. D. Masalchi

Grade III
Mr B. D. Mandal
Mr T. C. Balmiki
Ms M. Paul
Mr R. Das
Mr R. N. Prasad
Mr R. Chowdhary

New Appointment: Dr Dilip Kumar took over as the Director on 30.09.2005.

Promotions

S. no.	Name	Designation	Promoted as
Meeting held on 27.08.2005			
1.	Ms A. T. Landge	T-6	T-7/8
2.	Dr A. K. Jaiswar	T-6	T-7/8
3.	Dr C. S. Chaturvedi	T-6	T-7/8
4.	Dr P. P. Srivastava	T-6	T-7/8
5.	Mr A. Dwivedi	T-6	T-7/8
6.	Mr R. D. Tandel	T-6	T-7/8
7.	Mr R. R. S. Patnaik	T-4	T-5
8.	Mr K. R. K. Reddy	T-4	T-5
9.	Mr P. Satyanarayana	T-4	T-5
10.	Mr S. G. S.Zaidi	T-6	T-7/8
11.	Mr G. K. Rao	T-6	T-7/8
12.	Mr S. K. Pandey	T-6	T-7/8
13.	Ms R. Sharma	T-6	T-7/8
14.	Mr P. S. Rao	T-6	T-7/8
Meeting held on 13.01.2006			
1.	Mr B. K. Rao	T-4	T-5
2.	Mr M. Gyas	T-4	T-5
3.	Mr Krishna Kumar	T-1	T-2
4.	Mr Om Prakash	T-1	T-2
Meeting held on 21.02.2006			
1.	Mr D. R. Khogare	T-5	T-6
2.	Mr S. K. Sharma	T-5	T-6

Retirements

S. no.	Name	Designation	Retired on	Place of posting
1	Mr K. D. Solanki	SS Gr. IV	31.07.2005	Headquarters
2	Mr S. S. Murty	T-2	31.07.2005	Kakinada
3	Mr A. K. Mondal	T-5	31.10.2005	Kolkata Centre
4	Mr Pooranchand	Assistant	29.12.2005 (FN)	Lucknow Centre
5	Mr A. R. Warange	T-7/8	31.12.2005	Headquarters
6	Mr P. D. Sonawane	A.O.	27.02.2006 (FN)	Headquarters
7	Mr R. K. Biswas	T-5	28.02.2006	Kolkata Centre

Transfers

S. no.	Name	Designation	From	To
1	Mr Suresh Kumar	Senior Administrative Officer	CIFE Headquarters	National Bureau of Pla Genetic Resources, Ne Delhi
2	Mr Prem Shankar	Finance and Accounts Officer	CIFE Headquarters	ICAR Research Comple for Eastern Region, Pa
3	Mr G. C. Prasad	Finance and Accounts Officer	ICAR Research Complex for Eastern Region, Patna	CIFE Headquarters
4	Dr W. S. Lakra	Principal Scientist	CIFE Headquarters	National Bureau of Fis Genetic Resources, Lucknow
5.	Mr V. G. Dubey	T-5	Powarkheda Centre	IARI Regional Centre, Indore

16 कार्यकारी सारांश

केन्द्रीय मात्स्यिकी शि ा संस्थान की स्थापना सन् 1961 में की ई थी । इस संस्थान को भारतीय कृषि नुसंधान परिषद के ंत ात समतुल्य विश्वविद्यालय का दर्जा प्राप्त है । इस संस्थान ने पने स्थापना काल से ब तक शै णिक, नुसंधान एवं विस्तार कार्यक्रमों के तहत भारत में मत्स्य विकास के ोत्र में हम् भूमिका निभाई है । संस्थान की वर्ष 2005-06 वधि की उपलब्धिय ों का सं िप्त प्रतिवेदन इस प्रकार है ।

संस्थान के वैज्ञानिक 30 संस्था ात परियोजना ों तथा 15 बाह्य वित्त पोषित परियोजना ों पर नुसंधान कार्य कर रहे हैं । इनमें से एक-एक परियोजना संस्था ात सहकारिता का इंडो नार्वेजियन कार्यक्रम तथा ंतरराष्ट्रीय कृषि नुसंधान का ास्ट्रेलिया केन्द्र से संबंधित है । इसके साथ ही तीन प्रौद्यो ाकी परियोजनाएं भी प्रायो ाक स्तर पर कार्यरत हैं । इस वधि में पिंजड़ों (केज) में ंुलिका ों का संवर्धन तथा खुले जल में खाने यो य मछलियों के पालन संबंधित शोध उपलब्धि प्राप्त की ई ।

कॉमन कार्प में ल्पकालीन डेल्टामेतरीन तनाव में सुधार लाने हेतु एस्कोर्बिक एसिड का उपयो ा, क्ले टाइप का प्रभाव, जेनोबायोटिक्स की विषालुता में कार्बनिक तत्वों एवं कैल्शियम कार्बोनेट का घुलन, कम तापमान में संदीप्ति बैक्टिरीया का हिस्टेमिन फार्मिं ा की ामता, रोहू के स्वास्थ्य सुधार हेतु ाहार, मुंबई की मछलियों की ाठ प्रजातियों व सेफालोपोड की तीन प्रजातियों की बढ़ोत्तरी, जीवितता दर तथा स्टाक निर्धारण, न्तरस्थलीय लवणीय जल में एशियन कैटफिश का बीज उत्पादन, भारतीय सी फूड के जोखिम निर्धारण का डाटाबेस ादि का ध्ययन किया ाया ।

संस्थान के शै णिक कार्यक्रमों के ंत ात सभी ातिविधियां सुचारु रूप से संचालित की ई । इस वर्ष 38 छात्रों ने एम.एफ.एस.सी. तथा 18 छात्रों ने पी-एच.डी. की उपाधि प्राप्त की । इसके साथ ही 25 छात्रों ने न्तरस्थलीय मात्स्यिकी में स्नातकोत्तर स्तर का डिप्लोमा प्राप्त किया ।

इस वर्ष 45 छात्रों ने एम.एफ.एस.सी. व 23 छात्रों ने पी-एच.डी. की क ा ों में प्रवेश लिया । 23 प्रशि णार्थियों ने न्तरस्थलीय मात्स्यिकी में स्नातकोत्तर स्तर के डिप्लोमा पाठ्यक्रम हेतु प्रवेश लिया । एम.एफ.एस.सी. (एफ. ार.एम.) का एक छात्र सिं ापुर में ल्प प्रशि ण हेतु ाया । उसे हीरालाल चौधुरी छात्रवृत्ति के तहत एम.एफ.एस.सी. में सर्वोच्च ंक प्राप्त करने पर भेजा ाया । इसी प्रकार पी-एच.डी. में सर्वाधिक ंक प्राप्त करने वाले एक छात्र को टाटा विदेशी नुसंधान छात्रवृत्ति योजना के पाठ्यक्रम के तहत् डेनमार्क में ल्पकालीन नुसंधान प्रशि ण हेतु भेजा ाया । एक पी-एच.डी. छात्र को यं ा साइंटिस्ट वार्ड 2005 प्राप्त हु ा तथा एम.एफ.एस.सी. के एक छात्र को एशियन फिशरीज सोसायटी की भारतीय शाखा के सातवें इंडियन फिशरीज फोरम में बेस्ट पोस्टर प्रजेंटेशन वार्ड प्राप्त हु ा ।

इस वर्ष सी.ए.एस. के ंत ात दो प्रशि ण कार्यक्रम संचालित किए ाए । पहला प्रशि ण फिनफिश एवं शेलफिश के स्वास्थ्य प्रबंध में रो ा निदान का ाधुनिकीकरण तथा दूसरा प्रशि ण जलीय संवर्धन में जैव रसायन तथा मोलिक्युलर तकनीकी से संबंधित था । एक समर स्कूल जलीय संवर्धन में जलीय सू मजीवी से संबंधित विषय पर ायोजित किया ाया ।

संस्थान ने इस वधि में नौ

सम्मेलनों/सं ोष्ठियों/कार्यशाला ों एवं बौद्धिक मंथनों का ायोजन किया । संस्थान के वैज्ञानिकों ने 19 प्रशि ण कार्यक्रमों/समर स्कूल/विंटर स्कूल में भा ा लिया तथा 45 सम्मेलनों/सं ोष्ठियों/कार्यशाला ों/ परिसंवादों/फोरम/कां्रेस एवं 10 बौद्धिक मंथनों के जा ारुकता कैम्पों/मत्स्य मेला ादि में भा ा लिया, जो कि राष्ट्रीय एवं ंतरराष्ट्रीय स्तर के थे । संस्थान के दो वैज्ञानिक नार्वे के इंन्स्टिट्यूट ाफ एक्वाकल्चर रिसर्च में प्रशि ण हेतु ाए ।

इस वर्ष विस्तार उपलब्धियां भी सराहनीय रही । संस्थान ने बिहार के मछु ारों हेतु मीठा पानी महाझींगा बीज उत्पादन एवं संवर्धन विषय पर विशेष प्रशि ण के साथ ही 29 ल्पकालीन प्रशि ण संचालित किए । संस्थान ने देश के विभिन्न भा ों में ायोजित 19 मेला/प्रदर्शनी में सहभाि ता की । संस्थान के वैज्ञानिकों ने नौ दूरदर्शन एवं एक रेडियो वार्ता में भा ा लिया । इसी के साथ 119 मत्स्य पालकों/उद्यमियों एवं इच्छुक व्यक्तियों को तकनीकी जानकारी व सलाह सेवा प्रदान की । छह मत्स्य प्र ोत्रों में रो ा निदान का कार्य तथा ावश्यक उपचार किया ाया । उत्तर प्रदेश के किसानों के लिए पालीकल्चर के साथ स्कैम्पी संवर्धन तथा कार्प बीजों की बढ़ोतरी का सफल प्रयो ा किया ाया । ोत्र भ्रमण तथा ल्पकालीन प्रशि ण कार्यक्रमों के साथ ही मत्स्य प्रौद्योि की का विस्तार भी किया ाया । संस्थान में इस वर्ष 1988 ा ांतुकों को मत्स्य ातिविधियों से परिचित कराया ाया । इनमें प्राथमिक स्तर से लेकर उच्चस्तरीय छात्रों व प्रशि णार्थियों का समावेश था ।

संस्थान की विस्तार परिषद ने इस बात पर विशेष ध्यान दिया कि मत्स्य विस्तार सेवा ों को विकास ात माध्यमों से प्रबलता के साथ ा ो बढ़ाया जाए एवं प्र ाहण व संवर्धन मात्स्यिकी में सामुदायिक सहभाि ता के ाधार पर ोत्र विशेष का विस्तृत ध्ययन किया जाए ।

डा.एस.डी.सिंह को बायोवेद रिसर्च सोसाइटी, इलाहाबाद का फेलोशिप दिया ाया तथा डा.ए.के.पॉल को नेशनल एकेडमी ाफ वेटरीनरी साइंस की फेलोशिप दी ाई । डा. पर्णा चौधरी को फेलोशिप वार्ड-2005 तथा डा. के. पानी प्रसाद को वायोवेड रिसर्च सोसायटी, इलाहाबाद का बेस्ट यं ा साइंटिस्ट वार्ड - 2006 प्राप्त हु ा ।

इस संस्थान को हिन्दी में काम करने पर राजर्षि टंडन वार्ड ला ातार तीसरी बार प्राप्त हु ा । इसी के साथ संस्थान को मुंबई की प्रतिष्ठित साहित्यिक व सांस्कृतिक संस्था ाशीर्वाद से चल राजभाषा शील्ड-2005 प्राप्त हु ा । संस्थान ने इस वर्ष ाई.सी.ए. ार. के ोत्रीय खेलकूद प्रतियोि ता के न्त ात कई पुरस्कार प्राप्त किए ।

संस्थान ने राष्ट्रीय एवं ंतरराष्ट्रीय स्तर के 48 शोध पत्र प्रकाशित किए तथा 19 सारांश/लेख ादि राष्ट्रीय व ंतरराष्ट्रीय स्तर की सं ोष्ठियों/परिसंवादों/फोरम/कां्रेस में प्रस्तुत किए व 19 पुस्तक/पुस्तकों के ध्याय उपलब्ध कराए ।

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