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29th All India Congress of Zoology

Ranching programme in Ganga by Sushree Uma Bharati, Hon'ble Union Minister of Water Resources and Ganga Rejuvenation

International workshop on bioinformatics

Inside

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About ICAR-CIFRI

Started as Central Inland Fisheries Research Station in March, 1947 at Barrackpore, West Bengal, ICAR-CIFRI has carved a niche in inland fisheries research. Induced fish breeding, composite fish culture and other scientific fish production practices developed during the sixties by the Institute helped in bringing the blue revolution in the country. Reservoirs and wetland fisheries management technologies developed and disseminated by the institute resulted in enhanced fish production from these resources. By the turn of the year 2000, the research and development agenda of the institute concerning inland open waters shifted from fish as the only benefit to ecosystem health and ecological benefits with emphasis on sustainability, livelihood and nutritional security. In addition to the Headquarters at Barrackpore and two Research Stations at Kolkata and Kochi, CIFRI has four Regional Research Centres at Allahabad, Guwahati, Bengaluru and Vadodara, through which the issues of inland open water fisheries are being addressed.

Director's Column

We are celebrating the Platinum Jubilee year of the institute and several programmes have been organized to commemorate the occasion in a befitting manner. International workshop in bioinformatics in fisheries and aquaculture, lecture by eminent personalities, workshop in Hindi are some of the notable examples.

A couple of externally funded projects have been sanctioned during these months. Some of them have got international funding. I am sure we will achieve significant results and we will be able to fulfill the expectations of the sponsores. Interesting studies have been conducted during this period on breeding of fish biology, fishing methods at Ganga, mud crabs at Narmada estuary, canal fisheries at Sundarbans, ecology and fisheries of floodplain wetlands and reservoirs, statistical analyses of water parameters of Chilika. Demonstrations of cage culture is continued in the reservoirs of HP. A couple of cage and pen culture experiments were also conducted under NEH components in Assam.

Hon'ble Union Minister Sushri Uma Bharti visited our institute and took part in a ranching progranne at Ganga. She felt satisfaction over the efforts of the institute. We successfully organized 29th All India Congress of Zoology. Besides these, some other regular meeting and events like IRC, IMC, *Hindi saptah*, world environment day, International yoga day, National fish farmers day, Independence day were organized/celebrated with fan fare and enthusiasm. The institute staff deserve compliments for this. Several of our staff were awarded with medals in different fora, I congratulate all of them. I welcome the newly joined staff including seven scientists and wish them all the best. Any suggestions from the learned readers to improve the quality of the Newsletter is welcome.

B. K. Das
Director

October, 2017

Publication Team

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All India Congress of Zoology

Inaugural ceremony

The institute, in association with Inland Fisheries Society of India (IFSI), Barackpore and Zoological Society of India (ZSI)-Gaya organized the 29th All India Congress of Zoology during 09-11 June 2017. Dr. J. K. Jena, DDG, Fishery Science; Dr. Nabarun Bhattacharya, Director, C-DAC; Dr. Dilip Kumar, Former VC, ICAR-CIFE, Dr. S. D. Tripathi, Former VC, ICAR-CIFE; Dr. M. Sinha, former Director, ICAR-CIFRI; Dr. S.C. Mukherjee, former Joint Director, ICAR-CIFE; Dr. Gopal Krishna, Director, ICAR-CIFE; Dr. P. N. Pandey, Working President, ZSI; Dr. B. N. Pandey, President, ZSI, Dr. B.K. Das, Director and Dr. B. K. Behera, Organising secretary were among the dignitaries present in the inaugural ceremony.

On this occasion number of books ('Nutritional value of Small indigenous fishes' in Assamese language, e-Atlas – water bodies of Odisha, and Road maps of North-Eastern states, Bihar, Odisha, West Bengal and Jharkhand and charts (Fishes of river Mahanadi Fishes of river Gandak in Hindi and English, Gastropods of River Mahanadi) were released. Awards were presented to the researchers for their contribution to the science by IFSI and ZSI. ICAR-CIFRI floating feed for cage culture was also released on this occasion. A total of 600 delegates (National and International) were participated in this congress. Exhibitions were organised during the mega event, where different ICAR institutes, State Fisheries Department, Central Govt. Agencies, University, Industry, Farm[illegible] th[illegible]

Inauguration of the exhibition stall by Dr. J.K. Jena

Technical session in progress

Altogether 9 sessions namely, General Zoology, Fisheries and Aquaculture, Inland Fisheries Management, Environmental & Pollution Technology, Molecular Biology and Bioinformatics, Aquatic Biodiversity and Conservation, Molecular Biology and Bioinformatics, Aquatic Biodiversity and Conservation were conducted. In the side line, the International Satellite Symposium on Fish Immunology was also organized.

Comprehensive planning for inland aquaculture development; stronger networking among fisheries scientists, ecologists and resource users; research on areas like surrogate broodstock development; formulation of low cost feed; disease management in openwater resources; application of modern technologies like mobile applications; biodiversity conservation; climate smart adaptation strategies; development of inland fisheries databases; strict regulation of banning pollution of water, soil and air; development of pollution remediation technologies were some of the recommendations of this congress.

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International Workshop on Bioinformatics in Fisheries and Aquaculture

The International Workshop on Bioinformatics in Fisheries and Aquaculture was jointly organized by Inland Fisheries Society of India (IFSI) and ICAR-CIFRI during 19-21 June 2017, at ICAR-CIFRI, Barrackpore as a part of the Platinum Jubilee celebrations of the institute. The workshop was attended by academics, researchers from India and abroad, leading entrepreneurs and bioinformatics experts from industry and CIFRI staff members. Prof. Sam Martin, Professor, Fish Physiology, University of Aberdeen, UK; Prof. Alex Douglas, University of Aberdeen, UK and Dr. A. K. Roy, Former Principal Scientist & Head of Social Sciences, Coordinator, Bioinformatics Centre, ICAR-CIFA were the dignitaries in the inaugural function. Prof. Martin briefly described the recent advancements in the field of biology and bioinformatics in different sectors including fisheries. Prof. Douglas opined that use of different tools of bioinformatics would unite researchers in fisheries sector across the world. Dr. A. K.

Inaugural session

Participants in practical session

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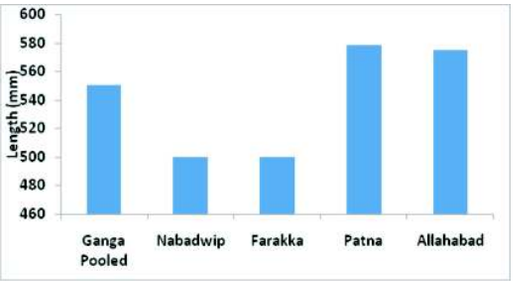
Research highlights

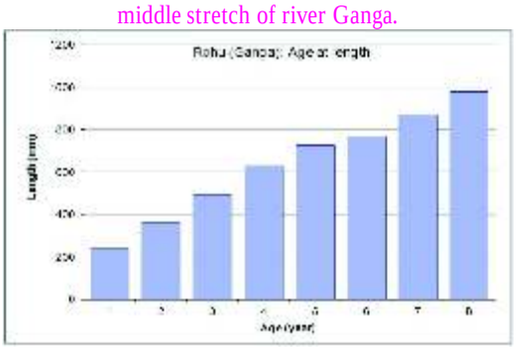
Variation in length at first maturity of *Labeo rohita* along the middle to lower stretch of Ganga

The length at which 50% of the females, representing the population, carrying ovaries with mature oocytes were considered as length at first maturity (L_{m50}). The pooled data, collected over the period of 2009-2013, showed that the species matured at 550 mm TL. The species showed significant variation in length at first maturity at different stations along the river. It matured at lower lengths at Nabadwip and Farakka (500 mm TL), while at Patna and Allahabad the fish matured at 578 and 575 mm TL, indicating lower length at first maturity along the lower stretch of Ganga, than the middle stretch.



Length at first maturity of *L. rohita* along the lower to middle stretch of river Ganga.

Chonder (Chonder, S. L. 1999. Biology of finfish and shellfish. SCSC Publishers, Howrah, West Bengal.514p.) reported that the species reach length at first maturity at 580mm at about 3-4 years of age in river Ganga. The present study showed that the fish matured at three years of age, while the same sized fish matured in two years during 1999. While the length, weight and age at first maturity remained agreeable with that reported by Chonder (1999). Reduced L_{m50} along the lower stretch of the river Ganga is one among the indications of overfishing. Length frequency data also showed serious overfishing of immature specimens at lower ages. The data also indicated lower rate of growth as the fish attained 500 g in two years in 1999, now it takes about three years to reach that size.



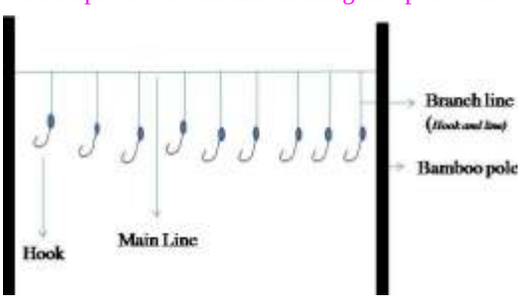
Age at length estimated for *L. rohita* during 2009-2013

V. R. Suresh, M. Naskar, M. P. Brahmane, B. K. Behera, Debabrata Panda, D. K. Meena, K. K. Lal, J. Mukherjee, D. K. Biswas, Y. Ali and A. K. Jana

Multiple hook and line fishing in the middle stretch of the river Ganga

The Multiple hook and line fishing is in vogue in the Farukhabad, Kannauj, Kanpur and Allahabad districts of Uttar Pradesh in the river Ganga. One to four fishers were involved in operation of this gear. It consists of a main line horizontally fixed to bamboo pole on either end and from which a number of hooks and lines measuring 6-10 cm are tied at an interval of about 1 meter. A single hook and line is locally known as "Joar". The main line is multifilament made up of Polypropylene and the same material is used for the branch line (hook and line) but with less thicker twine. The length of the main line varies between 16-100 meters with a number of hooks varies from 16-100. A number of bamboo poles are fixed in the river when the main line is more than 20 meters. The hook is made up of cast iron. The fishers use live bait (earthworm) and dead bait (small sized trash fishes like *Puntius* sp). This gear is mainly used in shallow and cut waters of floodplains of the river Ganga where the water flow is almost negligible mainly in monsoon season. In a fishing operation of 4-6 hrs, catch usually varies from 3-4 kg. The Major share of the catches is catfishes (*Rita rita*, *Mystus* spp) followed by eels (*Mastacembulus armatus*)

Multiple hook and line fishing in operation



Sketch of multiple hook and line fishing

S. C. S. Das, Absar Alam, D.N Jha, J. Kumar, V. R. Thakur, R. Das, V. Kumar, K. Srivastav, S. K. Srivastava, S.K.Verma, S.K. Mishra, J. Kumar, H.O. Verma and R. S. Shrivatava

Record of *Trichogaster Chuna* (Himlton, 1822) from the middle stretch of the river Ganga

Trichogaster chuna, popularly known as Honey gourami and locally called as Kholisa/Khasso, was observed from the river Ganga at Narora (Latitude: 28^0 13'54'', Longitude: 78^{0}26'12'' E). The species belongs to the Family-Osphronemidae and order-Perciformes. The number of individual retrieved was only one. The IUCN status of the species has been placed under Least Concern (LC) category. Among the species belonging to the Genus Trichogaster, *Trichogaster chuna* is the smallest member. *T. chuna* is omnivorous in nature, feed on small invertebrates,

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insects, & other zooplankton. *T. chuna* is bright honey yellow in color with a black band located on the mid dorsal profile of the body extending just behind eye to the base of the caudal fin. Fin Formula for the species was D XVI 7, P 8, A XX12. Some of the important water quality parameter of the habitat viz. water temperature, pH, transparency, dissolved oxygen, specific conductivity, total dissolved solids, alkalinity and hardness were 24^{0}C, 7.6, 37.0 cm, 7.28 ppm, 202.5µS/cm, 116.4 ppm, 83.00 ppm and 96 ppm, respectively.

Trichogaster chuna (Hamilton, 1822)

Absar Alam, S. C. S. Das, Jeetendra Kumar, D. N. Jha, R. S. Srivastava, B. K. Das, S. K. Verma, H. O. Verma and S. K. Mishra

Mud crab fishery at Narmada estuary, Gujarat

Scylla serrata (Forsskål, 1775) commonly known as mud crab and locally known by *'Karachala'* is an economically important species at Narmada estuarine region, Gujarat. This species is found to be caught at middle and lower stretch of estuary during low tides throughout the year especially in winter. *'Geri'* is an indigenous fishing device locally made by the fishermen with the help of iron rod. The gear is cost effective and is simple to make, a fishermen can catch 1-5 kg of crabs in a single day and while catching through hand picking, an individual fisherman can harvest 0.5 to 3.0 kg of crab in a day. Other than *S. serrata*, the species *Scylla tranquebarica* (Fabricius, 1798) under mud crab is also recorded in the estuarine region. Harvesting of mud crabs is also done by bag net, stake net and gill net. A wide size range is recorded with 85 to 700 gm and the price mainly depends upon size of the respective species. Total production of crabs in the estuarine region estimated as 40 t during the year 2014-15 and contributed little more than 2% of the total estuarine catch.

Fisherman with 'Geri' and harvest

Harvesting of mud crab through hand picking

Dibakar Bhakta, W. Anand Meetei, Vaisakh G., S. Kamble, J.K. Solanki, S.K. Das and B.K. Das

Canal fisheries development for livelihood support of local community of Sundarbans

The canal resources in Indian Sundarbans covered an area 907.33 ha which has vast potential for fisheries. ICAR-CIFRI initiated activities for fisheries development in Bhetkimari and Bishalakhi khal at Madanganj and Sagar Island respectively. Bhetkimari khal is 3.5 km long associated with Hathenia-Dewania river. The mean depth of the canal recorded 1.25 m and width 20 m. On the other hand the Bishalakhi khal is 1.5 km long linked with Hooghly river. The depth is slightly higher (2.5 m) compared to Bhetkimari khal and width 25 m. Major fishes observed *Anabus testudineus, Pethia ticto, Puntius sophore, Channa punctatus, Amblypharyngodon mola, Mystus gulio, Macrognathus* spp., *Trichogaster* spp., *Chanda* spp. and small prawn *Macrobrachium equidens* in both the canal. About 79% of the people living adjoining the canal are engaged in fishing activities. These two canals supports livelihood of 130 households in Bhetkimari and 250 households in Bishalakhi. Low-cost seasonal enclosure (net screen) culture practice may be an option for increasing fish production in the canal as well as livelihood support of the locality.

Discussion with villagers of Bishalakhi khal

Erection of net screens at Bhetkimari khal

Archana Sinha, P. Gogoi, S. K. Das, M. Ramteke, T. Tayung, Manas, H. M. and A. Roy

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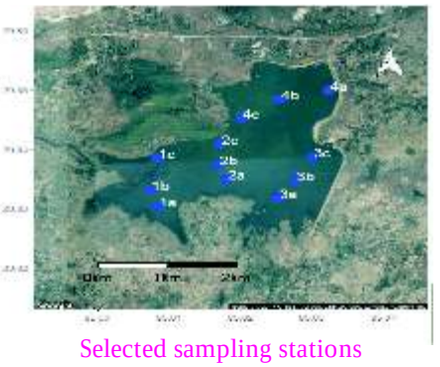
Assessing ecology and fisheries of Derjang reservoir, Odisha for fisheries enhancement

A systematic survey was carried out in a small reservoir, Derjang (20°50'32.0"N, 85°01'14.8"E), located at Banarpal Block of Angul District, Odisha. The source of water for the reservoir is Lingara and Matalia canals which are connected with Brahmani through Bouli river. The mean water surface area of the reservoir is 530 ha which provide livelihood to about 150 fishermen registered under Kalapata Primary Fisheries Co-operative Society. The reservoir is a shallow (mean depth 3.67 ± 2.85m). Fisheries management is under private ownership and for fisheries enhancement generally stocking is done twice (i.e. Sept- Oct and March-April) in a year with IMC and prawn (*Macrobrachium malcolmsonii*).



Selected sampling stations

During survey, a total of 16 physico-chemical parameters were analysed and found optimum for fisheries enhancement. The analysis of plankton samples revealed a total of 42species and four groups of phytoplankton and a total of 15 species and four groups of zooplankton. Twenty-eight fish species were recorded . Fish catch per day during monsoon was estimated 342kg of which IMCs contributed 76% followed by self recruiting small indigenous fish (11%) and prawn (5%). Productivity of reservoir was estimated about 200kg/ha during 2016-17.

Interaction with fishermen at landing centre

Lianthuamluaia, P. Majhi, T. Tayung, A.K. Bera, U. K. Sarkar, K.M. Sandhya, SumanKumari, Mishal P., G.Karnatak, M.A. Hassan, A.K. Das

Status and production potential of Jargo reservoir of Uttar Pradesh

Jargo reservoir (25°01'45.07" N and 82°56'57.4"E) in Mirzapur district of Uttar Pradesh has been constructed on the Jargo river during 1956-58. Apart from Jargo river, four more seasonal rivers such as Panchwahini, Kumahiya, Barahi, Mamniya feed the reservoir. The area of the reservoir is 3108 ha and its catchment area is around 40145 ha. A total of 32 species of fish belonging to 23 genera 13 families and 7 orders were recorded. The study recorded 25 species of plankton of which Chlorophyceae (10 species) was dominant. Total fish catch was increased from 31.85 tonnes in 2007 to 173.1 tons during 2014. A total of 100-150 fishermen families depend on the reservoir for their livelihood. *Labeo rohita* was found most dominant species in the catch followed by *Spereta seenghala*. The average gross primary production was observed to be 288 mgC/m^3/hr. The energy fixed by the primary producers accounted to 3456 cal/m^2/day, depicted a photosynthetic efficiency of 0.18% in the reservoir. Considering the photosynthetic efficiency, the production potential at 1.2% of energy conversion was estimated at 127 kg/ha. While present average fish yield of the reservoir was recorded around 40.24 kg/ha. The study indicates that reservoir has high production potential which can be realized through species enhancement and improved management option.

Jargo dam on the river Jargo in Mirzapur, U. P

A. Alam, J. Kumar, Vijoy Kumar and U. K. Sarkar

Cage culture in Govind sagar and Pong reservoirs

During 2016, the Institute has initiated activities to demonstrate the cage culture technology in Govind sagar and Pong reservoirs of Himachal Pradesh in collaboration with Department of Fisheries (DoF), Govt. of Himachal Pradesh. Advanced fry of *Pangasianodon hypophthalmus* with an avg. length of 7 ± 0.81 cm and avg. wt. of 2.54 ± 0.92 g were stocked @6250 numbers/cage in 48 HDPE floating cages (6m × 4m × 4m) installed in these two reservoirs. The fish stocks were regularly monitored for growth performance and health condition. The stocks were fed with 32% crude protein floating pellet feed @8% body weight during initial three months. Feeding was scheduled thrice a day (09.00 hrs, 13.00 hrs and 16.00 hrs). Afterwards, it was reduced to 5% body weight and feeding was done twice a day with reduced crude protein of 28%. After five months, the avg. length and avg. wt. of fish were 35.11 ± 1.97cm & 642.6 ± 107.28 g and 27.58 ± 4.8 cm & 323.8 ± 146.08 g respectively at Pong and Govind sagar reservoir. This result indicated that cage culture can be a potential tool for

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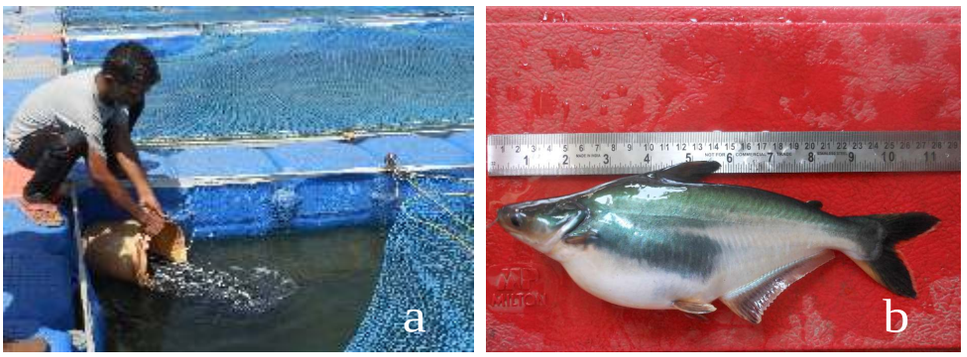


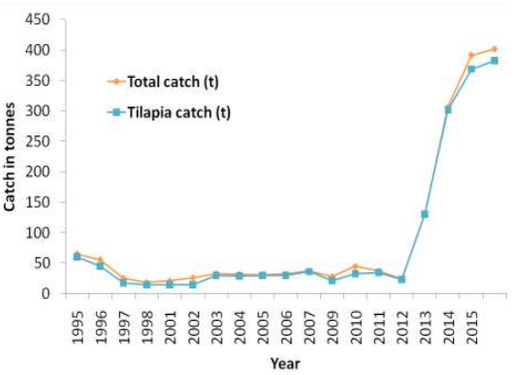
.a - Releasing seedsto the cages; b - Sampling of fish

increasing productivity in the reservoirs of Himachal Pradesh as well as in the northern states of Himalayan region which can generate employment opportunity and provide better livelihood to the local fishers.

T. Tayung, A. K. Das, M. H. Ramteke, B. K. Das, U. K. Sarkar

Tilapia dominates the catch in Krishnagiri reservoir, Tamilnadu

Krishnagiri reservoir (12°29'37.44"N; 78°10'41.51"E) is a medium reservoir constructed across Thenpennai river in Tamil Nadu. The area at Full reservoir level (FRL) is 1232 ha. The data on fish catch for the period 1995-2016 revealed that tilapia dominated the catch. The same acted as the determining factor for total fish catch from this reservoir. The experimental fishing conducted at the reservoir in July, 2017 (monsoon) obtained a total of 11 fish species belonging to 8 genera under 6 families and 4 orders. Though the reservoir was stocked with Indian Major Carps, 80% of this fish catch constituted of tilapia (58% Oreochromis niloticus, 22% O. mossambicus) while carps and other small indigenous fishes contributed only 20% of the total catch. This calls for the study on impact of stocking in this reservoir.



Total fish catch and tilapia catch in Krishnagiri reservoir, Tamilnadu

Jesna P. K., Ramya V. L., Sibina Mol S., Ajoy Saha, Preetha Panikkar and Karthikeyan, M.

Effect of stocking practices and riverine connectivity on fish productivity of *beels* of Assam

Fish species composition in three *beels* of Assam having different stock enhancement regimes and riverine connectivity was studied during 2012-17. Three *beels*, i.e., Sukdol-Sarubari (no stocking, open), Mer (high density stocking @ 2500-3000 fingerlings/ ha, seasonally open) and Damal (moderate density stocking @ 1500-2000 fingerlings/ ha, closed) were selected for the study. The highest number of species was recorded from Sukdol-Sarubari with a total of 34 species representing 13 families, whereas a total of 30 and 26 species were observed in Damal and Mer *beel*, respectively (representing 12 families). Stocking practice apparently affected the catch composition in the stocked *beels* as 70-75% of the catch (on weight basis) was contributed by stocked fishes while the remaining comprised of indigenous wild fishes. In the unstocked *beel*, small indigenous fishes contributed to 85% of catch mainly comprising *Puntius* spp. It was seen that the stocking led to increasing fish production as the average fish yield was highest in Mer *beel* (1385 kg/ha/y) having high density stocking followed by moderately stocked Damal (924kg/ha/y) and unstocked Sukdol-Sarubari (487kg/ha/y) *beels*. The present study suggested that riverine connectivity of *beels* supports more species diversity, whereas supplementary stocking enhances fish yield per unit area of *beels*.

S. Yengkokpam, B. K. Bhattacharjya, D. Debnath, Pronob Das, A. K. Yadav, K. K. Sarma, N. Sharma, S. Borah, A. Kakati and N. S. Singh

Fish diversity in three unexplored floodplain wetlands of Meghalaya

Fish diversity of three floodplain wetlands of Meghalaya was assessed for the first time during 2015-16. Among the selected wetlands, Boro *beel* (N 25° 44.49.9'& E 89° 57.75.5') is a medium sized (80 ha) perennially open waterbody located in West Garo Hills district (connected with River Jinjiram). Katuli *beel* (N 25°28.25' & E 89°52.29') is a small sized (36 ha) seasonally open wetland located in South West Garo Hills


Mer beel, Nagaon district


Damal beel, Morigaon district


Sukdol-Sarubori beel, Morigaon district

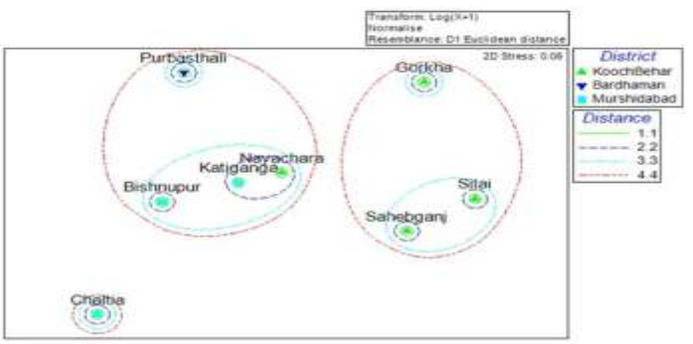
district (connected with R. Daru and Durni); and Kumligaon *beel* (N 25° 30.42' & E 89° 54.28') is a small sized (20 ha) seasonally open waterbody located in South West Garo Hills district (connected with Jonjona channel). Boro and Katuli *beels* were managed as capture fisheries, whereas Kumligaon *beel* was managed as capture fisheries with occasional supplementary stocking and was leased by Garo Hills Autonomous District Council. A total of 65 nos. of fin fish species were recorded during the present study from Boro *beel*. Lesser number of fish species were recorded from Katuli (54 nos.) and Kumligaon (57 nos.) *beel*. Finfish species recorded from the *beels* were dominated by the Order Cypriniformes followed by Siluriformes and Perciformes. Family Cyprinidae contributed to the highest numbers of species followed by Bagridae and Channidae. Sporadic landing of *Hilsa ilisha* was reported in Boro *beel* indicating migration of anadromous Hilsa to the *beel* from R. Brahmaputra through River Jinjiram. A banned exotic carnivorous catfish, *Clarias gariepinus* was reported by the local people from all the *beels*.

View of Boro, Katuli and Kumligaon beels of Meghalaya.

Pronob Das, B. K. Bhattacharjya, A. K. Yadav, D. Debnath, S. Yengkokpam, K. K. Sarma, A. Kakati and B. K. Das

Culture based fisheries technology is an ideal option for fisheries enhancement in *beels* of West Bengal

An exploratory survey was conducted during 2016-17 in nine wetlands namely Purbasthali, Bodokobla, Katiganga, Bishnupur, Chaltia in Bhagirathi-Hooghly stretch of lower Gangetic basin and Nayachara, Gorkha, Sahebganj and Sitai in Teesta-Torsa basin in West Bengal to understand ecology, fisheries, institutional arrangement and technology adoption in these wetlands. Analyses of ecological parameters following Multidimensional Scaling (MDS) method indicated that wetlands located in the two different basins are distinct in terms of ecological characters barring Katiganga and Nayachara showing ecologically proximal features. The study revealed that wetlands in rural Bengal are mostly eutrophic and urban/peri-urban wetlands are highly eutrophic. The culture based fisheries technology has been adopted by most of the resource managers and there is still scope for further enhancement as in some cases the production



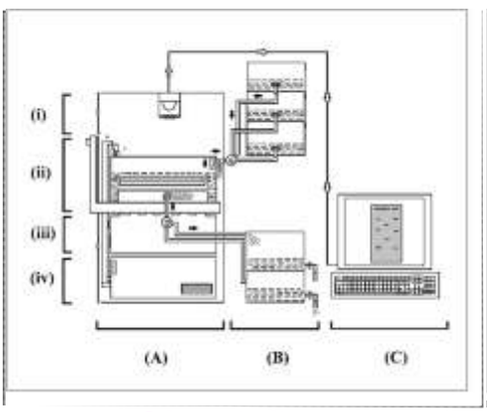
Multi Dimensional Scaling of the physico-chemical parameters of selected wetlands from different districts of West Bengal

is still sub-optimal. The studies indicated that there was general decline of indigenous fish fauna due to over fishing, habitat aberration and lack of awareness that require attention by the researchers, resource managers and policy makers.

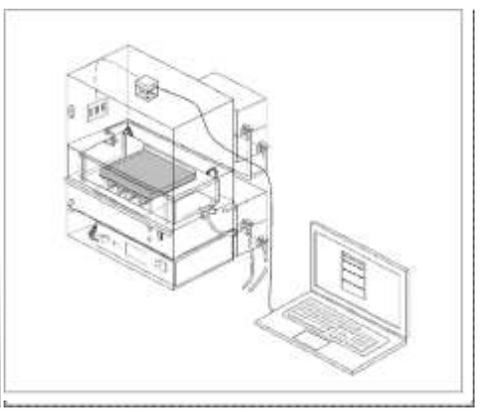
M. A. Hassan, Md. Aftabuddin, Arun Pandit, D. K. Meena, Sandhya K.M., Mishal P, Suman Kumari, Lianthuamluaia, P. Majhi, U. K. Sarkar and B. K. Das

Electrophoresis-cum-staining apparatus for DNA agarose gel

Agarose gel electrophoresis is a routinely used technique mainly for separation of nucleic acids in almost every biochemical laboratory around the world. Gels are run, stained and visualized using different dedicated equipments and reagents under laboratory conditions to obtain desired results. The complete process of size fractionation of nucleic acids by horizontal gel electrophoresis to the visualization by dye staining sometimes becomes tiresome and unsafe due to the involvement of many procedural steps and harmful chemicals. A safe, inexpensive, time-saving and comprehensive apparatus for gel electrophoresis, staining and imaging is fabricated and tested. This newly modified apparatus has uncomplicated operation and requires pre-existing lab equipments along with off-the-shelf components for construction in the laboratory. The apparatus has been proved to be an added advantage to carry out agarose horizontal gel electrophoresis and associated techniques with ease and simplicity.



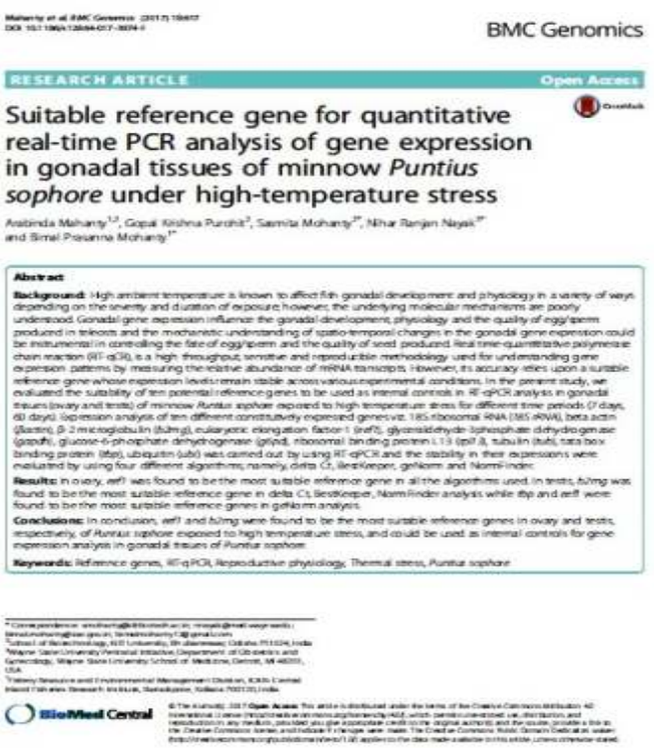
Schematic diagram


Functional apparatus

Praveen Maurye

Suitable reference gene for quantitative real-time PCR analysis of gene expression in gonadal tissues of *Puntius sophore* under high-temperature stress

High ambient temperature is known to affect fish gonadal development and physiology in a variety of ways depending on the severity and duration of exposure. Real time-quantitative polymerase chain reaction (RT-qCR), is a high throughput, sensitive and reproducible methodology used for understanding gene expression patterns by measuring the relative abundance of mRNA transcripts. However, its accuracy relies upon a suitable reference gene whose expression levels remain stable across various experimental conditions. We evaluated the suitability of ten potential reference genes to be used as internal controls in RT-qPCR analysis in gonadal tissues (ovary and testis) of minnow Puntius sophore exposed to high temperature stress for different time periods (7 days, 60 days). Expression analysis of ten different constitutively expressed genes was carried out by using RT-qPCR and the stability in their expressions were evaluated by using four different algorithms; namely, delta Ct, BestKeeper, geNorm and NormFinder. eef1 and b2mg were found to be the most suitable reference genes in ovary and testis, respectively, of Puntius sophore exposed to high temperature stress, and could be used as internal controls for gene expression analysis in gonadal tissues of Puntius sophore.


BMC Genomics

RESEARCH ARTICLE Open Access

Suitable reference gene for quantitative real-time PCR analysis of gene expression in gonadal tissues of minnow *Puntius sophore* under high-temperature stress

Abstract

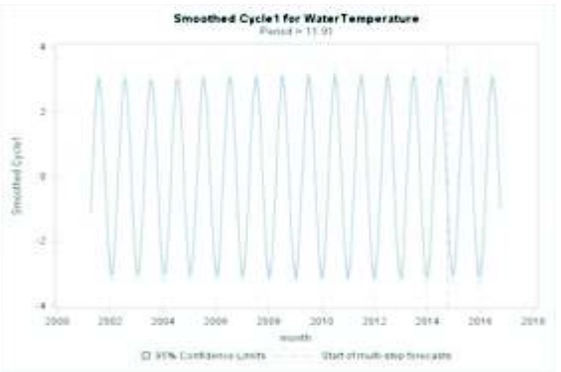
Keywords: Reference genes, RT-qPCR, Reproductive physiology, Thermal stress, Puntius sophore

BioMed Central

A. Mahanty and B.P. Mohanty

Cyclic and trend behaviour of water temperature of Chilika lagoon

Chilika lagoon is ecologically divided into four different zones namely Northern, Central & Southern sectors and the outer channel area. The lagoon represents a rich source of biodiversity. Fish catch of the lagoon plays a significant role for sustaining livelihood and nutritional security for millions of poor fish farmers. Abiotic parameters such as water temperature plays an important role to maintain the fish biodiversity in the lagoon. Historical average monthly time series data on water temperature (^{0}C) of the lagoon was analysed from April, 2001 to March, 2015 using unobserved components models (UCM) to understand the cyclic and trend behaviour of the lagoon. The average temperature during this period was found 28.65^{0}C with range 21.66-33.93^{0}C with 9.5% coefficient of variation. The results shows that water temperature cycle is stationary and of 12 months (~ 11.92 month), ($p < 0.05$) a steady deterministic trend was observed. Fig.1 and 2 . The analysis further showed that the water temperature cycle and trend will maintain the present pattern for the future period 2017-18 present ecological situations prevail.



Cycle behaviour of water temperature of Chilika lagoon for the period 2001 to 2015

R.K.Raman, A.K.Sahoo, B.P. Mohanty and B.K.Das

Activities under NEH

Fish stock enhancement led to increased fish production in Mer *beel*, Assam

ICAR-CIFRI Regional Centre, Guwahati in collaboration with AFDC Ltd., Guwahati carried out fish stock enhancement in Mer *beel* (seasonally open, water spread area 20 ha), Morigaon district of Assam under the NEH component of the Institute. Stunted fish fingerlings were raised in rectangular pens (4 no. each having 2500 m^{2}area) installed in marginal areas of the *beel.* Six species of carps *Labeo rohita, Catla catla, Cirrhinus mrigala, L. gonius, Ctenopharyngodon idella* and *Hypophthalmichthys molitrix* were stocked @ 5 nos. /m^2. After rearing for 5 months in the pen stunted carp fingerlings (40,000 no.) were released to the *beel* proper for fish stock enhancement during January 2016. The fish yield rate during 2016-17 was recorded as 1465 kg/ha/yr. Supplementary stocking resulted in 12.6% increase in fish yield rate from the previous year from the beel.

Pen installed in Mer beel, Morigaon district, Assam

Fish harvest in Mer beel

B. K. Bhattacharjya, S. Yengkokpam, A. K. Yadav, P. Das, D. Debnath, N. Sharma, S. Borah, N. S. Singh, K. K. Sarma and A. Kakati

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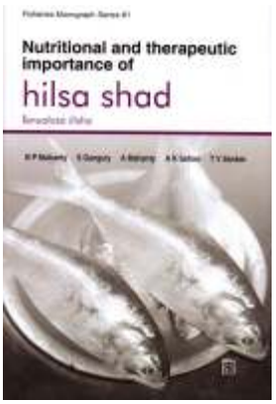
CIFRI-GI Cages installed in Samaguri *beel*, Assam

A battery of CIFRI-GI cages (16 no.) were installed in Samaguri *beel* of Nagaon district, Assam on April 25th, 2017. The dimension of individual cage was 5 x 5 x 2 m^3. An experiment for rearing minor carp, *Labeo bata* to table size has been currently underway in the cages. This cages will also be used to demonstrate cage aquaculture for rearing high-value fishes to beel fishers/ lessees of the state.

Book published

Nutritional and therapeutic importance of hilsa shad *Tenualosa ilisha*. 2017, Narendra Publishing House, Delhi, ISBN: 978-93-86110-32-9

Authors: B. P. Mohanty, S. Ganguly, A. Mahanty, A. K. Sahoo and T. V. Sankar



Traditionally, the fish hilsa, *Tenualosa ilisha* (Ham.) has been enjoyin high consumer preference due to its taste and other culinary properties. Biochemical studies have shown that hilsa is an oil rich fish and contains high amount of health friendly fatty acids, omega(ω)-3 poly unsaturated fatty acids (ω-3 PUFAs), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) content. In the western world, fishes like Salmon, Cod, Tuna and Mackerel are the chief sources of PUFAs especially EPA and DHA. In the South-East Asian countries hilsa, is one such fish which has a comparable amount of oil and PUFA content and can contribute to the maintenance of health of a large number of people. In this context, this monograph presents nutrient information on the highly prized fish which would be helpful in enhancing its utility in human health and nutrition and would be helpful in compelling all stakeholders to conserve hilsa and increase its production through aquaculture.

Trainings conducted

Model Training Course on 'Enclosure Culture in Inland Open Water'

Trainees attending a practical class

Trainees with the Faculty

The Institute organized a Model Training Course (MTC) on 'Enclosure Culture in Inland Open waters' during 22-29 August 2017 at Barrackpore. The objective of this MTC was to sensitize the participants regarding importance of enclosure culture technology for the sustainable enhancement of fish production in inland open waters. In the inaugural session Prof. C.S Chakrobarty, Former Vice Chancellor of West Bengal University of Animal and Fishery Sciences was the Chief Guest. Dr. B. K Das, Director, CIFRI remarked that enclosure culture including cage and pen culture could be the best alternative to meet the increasing demand of animal protein in the country for food security and for the improvement of the livelihood of many people in a sustainable manner. Dr. B.C Jha, Former Head, Reservoir and Wetland Division was also present on the occasion. A total of twenty two trainees from Jammu & Kashmir, Kerala, Maharashtra, Madhya Pradesh, Andhra Pradesh, Uttar Pradesh, Jharkhand, Rajasthan, Arunachal Pradesh, Assam, Odisha and West Bengal participated in the training programme.

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Other trainings organized

Sl. No.	Name of the training	Date	Participants	Venue
1	Inland Fisheries Management	10-13 April 2017	26 B.Sc. Students from S. K. Mahila College Begusarai, Bihar	CIFRI, H.Q. Barrackpore
2	Inland open water fisheries management & development	15-21 June 2017	26 (25+1) fishers/fish farmers from Buxar, Bihar (DoF)	CIFRI, H.Q. Barrackpore
3	Hands-on training on Collection, Preservation and Identification of Freshwater Plankton	11-14 July 2017	12 participants	ICAR-CIFRI, Barrackpore
4	Inland open water fisheries management & development	30 June -06 July 2017	30 (29+1) fishers/fish farmers from Sitamarhi, Bihar (DoF)	CIFRI, H.Q. Barrackpore
5	Inland Fisheries Management	10-14 July 2017	10 B.Sc. (Ag) 2nd year Students of MBA College, Saharsa, under BAU, Sabour Bihar.	CIFRI, H.Q. Barrackpore
6	Inland open water fisheries management & development	11-17 August 2017	31 (30+1) fishers/fish farmers from Munger, Bihar (DoF)	CIFRI, H.Q. Barrackpore
7	Inland Fisheries Management	17-26 August 2017	8 M.F.Sc. Students under FRM Division of ICAR-CIFE, Mumbai.	CIFRI, H.Q. Barrackpore
8	Inland open water fisheries management & development	18-22 August 2017	22 (21+1) fishers/fish farmers from Madhubani (ATMA)	CIFRI, H.Q. Barrackpore
9	Inland open water fisheries management & development	25-31 August 2017	28 (27+1) fishers/fish farmers from Jamui, Bihar (DoF)	CIFRI, H.Q. Barrackpore
10	Lab exposure visit and Hands-on Training Course on 'Contemporary Techniques in Fish Biochemistry'	01-12 September 2017	M.F.Sc. students of ICAR-CIFE (FNBP Division)	CIFRI, H.Q. Barrackpore
11	Inland open water fisheries management & development	07-13 September 2017	31 (30+1) fishers/fish farmers from Khagaria, Bihar (DoF)	CIFRI, H.Q. Barrackpore
12	Inland open water fisheries management & development	12-16 September 2017	10 (9+1) farmers from Subarnapur, Odisha (PD, ATMA)	CIFRI, H.Q. Barrackpore
13	Inland open water fisheries management & development	14-20 September 2017	31 (30+1) fishers/fish farmers from Sheohar, Bihar (DoF)	CIFRI, H.Q. Barrackpore
14	Inland open water fisheries management & development	18-25 September 2017	25 (24+1) fishers/fish farmers from Begusarai, Bihar (DoF)	CIFRI, H.Q. Barrackpore


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1.Certificate distribution to Madhubani district fishers; 2. Student trainees learning lab technique; 3. ICAR-CIFE students with the faculty

Exhibitions participated

Sl. No.	Date	Particulars	Place
1	10-13 April 2017	Fish Festival -2017	Bhubaneswar, Odisha
2	13-19 April 2017	*Krishi Mela* - 2017	Motihari, Bihar
3	20-21 April 2017	International Symposium on 'Aquatic Animal Health and Epidemiology for Su stainable Asian Aquaculture' (ISAAE), organised by Aquatic Biodiversity Conservation Society, Lucknow in collaboration with ICAR -NBFGR & National Surveillance Programme on Aquatic Animal Disease. ICAR-CIFRI Allahabad RRC has participated	NBFGR, Lucknow, UP
4	15-19 May 2017	8th Krishi Fair – 2017, organised by Shree Shrikhetra Soochana, Puri	Puri, Odisha
5	24-27 August 2017	'21st National Agriculture Exhibition' organised by Central Calcutta Science & Culture Organisation for Youth	Vivekananada Krirangan, New Barrackpore, Kolkata
6	22-24 September 2017	National Seminar on 'Strategies, Innovations & Sustainable Management for Enhancing Coldwater Fisheries & Aquaculture' organised by ZSI, Bodhgaya & ICAR-DCFR, Bhimtal	Bhimtal, UK

Exposure / Educational Visits

Sl. No.	Particulars of visitors	Date of visit
1	20 Progressive fish farmers & 3 FEOs from Karbi Anglong, Dhipu, Assam	05-07 April 2017
2	7 M.Sc. Students & 1 Professor In charge from Department of Zoology, Pandu College, Guwahai University	05 April 2017
3	28 M.Sc. Microbiology Students, 1 Research Scholar & 1 Assistant Professor from Vidyasagar University, Midnapore	08 May 2017
4	13 M.Sc. Zoology Students & 2 Teachers from Vidyasagar College, Kolkata	17 May 2017
5	20 Trainees from Inland Fishery Research Centre (IFRC), Imphal, DoF, Govt. of Manipur	21 June 2017
6	40 Input Dealers in Agri & Aquaculture from KVK, 24 PGS (N) under DAESI program of MANAGE, Hyderabad	22 June 2017
7	12 M.Sc. Botany Students & 1 Teacher from Vidyasagar University, Midnapore.	24 June 2017
8	15 Students & 1 Faculty member from Future Hope School, Kolkata	11 July 2017
9	26 B. F. Sc. Students & 1 Teacher from College of Fisheries Science, Nellore, Andhra Pradesh	05 August 2017
10	81 Students & 4 Teachers In-charge from Army Public School, Barrackpore	17 August 2017
11	46 Students & 4 Teachers In-charge from Army Public School, Barrackpore	18 August 2017
12	21 trainees (PGDIF & FM) from ICAR-CIFE, Kolkata centre	08 September 2017
13	24 M.Sc. Zoology Students & 1 Teacher In -charge from Bodoland University, Assam	14 September 2017

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Mass awareness camps

Mass awareness camps	Place	Date
'Conservation of fishes of river Ganga' unde ICAR-CIFRI-NMCG	Milan Dwip, Balagarh, Hooghly, West Bengal	22 April 2017
Wetland management for upliftment of Tribal people	Rewa, M.P.	04 April 2017

Awareness camp at Balagarh

Staff Corner

Promotions

Name & Designation	Promoted to	With effect from
Dr. Ranjan Kumar Manna, Sr. Scientist	Principal Scientist	19 July 2016
Mrs. K. Sucheta Majumder Assistant Chief Technical Officer	Chief Technical Officer	01 July 2016
Shri Saket Kumar Srivastava Assistant Chief Technical Officer	Chief Technical Officer	01 January 2016
Shri Ranjit Kumar Roy	Assistant	21 June 2017
Shri Manish K. Singh	UDC	21 July 2017
Md. Fazal Khan	UDC	21 July 2017

Appointment

Name & Designation	Date of joining at ICAR-CIFRI
Shri Raushan Kumar, Assistant	29 September 2017
Shri Gauranga Ghosh, F & AO	ICAR-CIFRI Barrackpore on 25 April 2017 (adcitional charge)

Superannuations

Name & Designation	Last place of posting	Date of superannuation
Mr. T. K. Gayen, SSS	Barrackpore Hqs.	05 May 2017
Dr. M. K. Bandyopadhyay Pr. Scientist	Barrackpore Hqs.	30 September 2017
Mr. S. Karmakar Assistant	Barrackpore Hqs.	30 September 2017

Transfer from ICAR-CIFRI

Name & Designation	Transferred to	Date of relieving from ICAR-CIFRI
Shri S. K. C. Bose, SF & AO	ICAR-CPCRI, Kasaragod	07 April 2017
Dr. Manas H. M., Scientist	ICAR-CMFRI, Cochin	29 September 2017

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Transfer to ICAR-CIFRI

Name & Designation	Transferred from	Date of Joining at ICAR - CIFRI
Ms. Piyashi Debroy, Scientist	ICAR RC-NEH	01 April 2017
Mr. V. Ramrao Thakur, Scientist	ICAR-CIARI, Port Blair	05 April 2017
Mr. Kamble S. Prakash, Scientist	ICAR-CIFA, Bhubaneshwar	03 April 2017
Mr. Rahul Das, Scientist	ICAR RC NEH	11 April 2017
Dr. Hemanta Chowdhury, Pr. Scientist	ICAR CRIJAF, Barrackpore	19 April 2017
Dr. Dhruba Jyoti Sarkar, Scientist	ICAR IARI, New Delhi	01 July 2017
Shri N. Rajendra Naik, Scientist	ICAR CMFRI, Cochin	03 July 2017

Intra-institutional transfer

Name & Designation	Transferred from	Date of Joining at ICAR - CIFRI
Ms. Piyashi Debroy, Scientist	ICAR RC-NEH	01 April 2017
Mr. V. Ramrao Thakur, Scientist	ICAR CIARI, Port Blair	05 April 2017
Mr. Kamble S. Prakash, Scientist	ICAR-CIFA, Bhubaneshwar	03 April 2017
Mr. Rahul Das, Scientist	ICAR RC NEH	11 April 2017
Dr. Hemanta Chowdhury, Pr. Scientist	ICAR-CRIJAF, Barrackpore	19 April 2017
Dr. Dhruba Jyoti Sarkar, Scientist	ICAR-IARI, New Delhi	01 July 2017
Shri N. Rajendra Naik, Scientist	ICAR-CMFRI, Cochin	03 July 2017

Awards and recognitions

Dr. B. K. Das receiving the Eminent Zoologist Award

During the 29th All India Congress of Zoology (AICZ) many ICAR-CIFRI staff were honoured with awards for their outstanding contribution in inland fisheries and allied Sciences. Dr. B. K. Das, Director was conferred with Eminent Zoologist Award by the Zoological Society of India (ZSI), Bodhgaya. Dr. B. P. Mohanty and Dr. M. A. Hassan were conferred with the Fellowship of Inland Fisheries Society of India and Zoological Society of India, respectively. Dr. B. K. Behera and Dr. A. K. Das got Dr. B S Chauhan gold medal and Prof. Har Swarup award, respectively. Dr. A. K. Sahoo and P. K. Parida were conferred with the Congress of Zoology medal in the field of Fish and Fisheries 2017 while Drs. R. K. Raman, Kavita Kumari bagged Young Scientist and Dr. S. Samanta, D. K. Meena bagged Sr. Scientist medals.

Dr. B. P. Mohanty receiving the Fellowship of IFSI

Best Poster Award in the 29th AICZ:

Y T. Mitra, A. Mahanty, S Ganguly, L. R. Mahaver, S. K. Paul, and B. P. Mohanty for the poster 'Next generation sequence analysis of pollution stress responsive transcriptome of gill tissues of *Rita rita*'

Y A. K. Rout, B. Dehury, J. Maharana, C. Nayak,V. S. Baisvar, A. K. Jana, B. K. Behera and B. K. Das for the poster 'Molecular dynamic simulation, principal component analysis and binding free energy calculation in probing the ATP binding mechanism in Zebrafish Cyclin-depentent Protein Kinase like 1 (zCDKL1)'.

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Dr. B. K. Bhattacharjya

R. K. Manna, A. K. Das, S. Samanta, S. C. S. Das, A. Alam, B. K. Singh, K. D. Joshi, R. K. Raman, M. Naskar, U. Bhaumik and A. P. Sharma bagged the Best oral presentation award for their paper 'Time scale changes of water parameters of river Ganga in relation to fisheries' in the 29th AICZ.

B. K. Bhattacharjya served as an Expert member of Assam State Biodiversity Board, Guwahati for his excellent work on fish diversity of River Brahmaputra in Assam

Dr. R.K. Manna

Meetings

Institute Research Committee Meeting

The Institute Research Committee Meeting 2016-17 was held at the Institute headquarters during 10-12 April 2016. Dr. B. K. Das, Director chaired the meeting. All the Scientists of the institute attained the meeting. The Chairman motivated the scientists to publish their work in high impact factor journals. He also stressed upon value addition in research work and requested the scientists to be innovative in their approaches and stressed that the research should have relevance to the farmers, policy makers and other stakeholders. A interface meeting among Scientists, Technical officers and Administrative staff was also held and different issues were discussed. The Principal Investigators of the projects presented their research and other achievements made during 2016-17. Many new projects have been presented and discussed in the house.

Regional Consultation at Guwahti RRC

A Regional Consultation on 'Open water fisheries development in NE region' was organized by the institute at Guwahati on 29 April 2017. A total of 40 delegates attended the consultation. Shri Parimal Suklabaidya, Hon'ble Minister Fisheries, Assam was the chief guest. Dr. B. K. Das, Director, ICAR-CIFRI emphasized on the need for developing open water fisheries in the region and assured providing research support to the state fisheries department. Dr. P. K. Pandey, Dean, College of Fisheries (CAU), Lembucherra; Prof. K. K. Saharia, GB Member of ICAR and Dr. J. Chauhan, National Convener for Extension Education, Ministry of Agriculture and Farmer's Welfare, Govt. of India; The Directors of Fisheries, Govt. of Assam, Mizoram and Manipur also addressed the gathering. Scientists of the Guwahati RRC presented the road maps in the technical sessions on which the delegates provided inputs and suggestions.

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Stakeholders Consultation on National Inland Fisheries and Aquaculture Policy

A stakeholders consultation on 'Formulation of National Inland Fisheries and Aquaculture Policy' was organized by the National Fisheries Development Board, Regional Centre, Guwahati in collaboration with ICAR-CIFRI and ICAR-Central Institute of Fisheries Education (ICAR-CIFE), Mumbai at NIRD & PR, NERC, Guwahati on 16 June 2017. A total of 50 delegates including Shri A. K. Joshi, IFS, Joint Secretary, DAHD&F, New Delhi; Shri M. Chaudhury, Fisheries Advisor, NITI Ayog, Govt. of India; Dr. Dilip Kumar, Ex. VC, ICAR-CIFE, Mumbai; Dr. B. K. Das, Director, ICAR-CIFRI, Barrackpore; Dr. Gopal Krishna, Director, ICAR-CIFE, Mumbai; Shri S. K. Das, Director of Fisheries, Govt. of Assam. A policy document prepared by ICAR-CIFRI, Barrackpore entitled "Roadmap for development of openwater fisheries resources in Northeastern Region" was released on the occasion.

Workshop on 'Assessment of water and soil quality parameters'

This workshop was organized at the institute headquarters on 14 August, 2017. A total of 21 candidates, including technical persons and research fellows of various externally funded projects both from headquarters and other regional centres/research stations of ICAR-CIFRI attended the workshop. The Director stressed on the standardization of methods suitable for covering different locations, both at micro and macro level, different sizes of water body and seasonal variations. Dr. S. Samanta and Dr. S. K. Das, were the coordinators of this workshop.

46th Meeting of Institute Management Committee

The 46th Institute Management Committee meeting was held at the institute headquarters on 05 September 2017 under the chairmanship of the Director. The Chairman briefed the members about activities carried out by the Institute since last meeting. The members appreciated progress of research work at the Institute and complemented the Director and Scientists. Dr. A. K. Das, Principal Scientist of the institute delivered a presentation on enclosure culture of fishes in the IMC meeting

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Mid-term Institute Research Committee Meeting

The mid-term Institute Research Committee meeting for the year 2017-18 was held at the Institute Headquarters, Barrackpore on 18-19 September 2017. The objective of the meeting was to assess the achievements made so far and mid-course correction, if any. Dr. B. K. Das, Director, ICAR-CIFRI chaired the meeting. Scientists from the CIFRI Headquarters, Kolkata Research Station and Project Principal Investigators from Regional Centers/Stations attended the meeting. The Chairman informed the house about new international research collaborations including Norway, Canada and Japan. The house was also informed about the patent on low cost GI cage design and application for patent on Tissue embedding machine and fish feed. Following these the achievements were discussed and recommendations were made.

Sensitizing Workshop on J-gate

J-Gate is an electronic gateway to global e-journal literature. It provides seamless access to millions of journal articles available online offered by 13,243 Publishers. It presently has a massive database of journal literature, indexed from 48,055 e-journals with links to full text at publisher sites. A sensitizing workshop on J-gate as one stop platform for discovering scholarly journal articles was held on 19 September 2017.

Events

Exploratory Survey of Inland Fishery Resources of A&N Islands

Exploratory survey of inland fishery resource of A&N Islands

A team of Scientists from the institute visited A&N Islands during 02-06 May 2017 with a view to explore the feasibility of fisheries development in the inland open waters of the islands. The team was led by Dr. B. K. Das, Director; Dr. B. P. Mohanty and Dr. A. K. Das were the other members. The team interacted with Deptt Officials and visited most part of main islands of Andaman and interacted with the progressive farmers. The team had an overall assessment of the fisheries resources, fish species including exotics and found ample scope of fisheries development and enhancement both in freshwater sector and coastal zone. The team has identified several areas of intervention including delineation of inland water resources using GIS platform, feasibility of cage culture, simplifying quarantine procedure for easy access of good quality seeds in the Islands form the main lands etc.

Ranching Programmes for Conservation and Restoration of Ganga fishery

Ranching programme of Mahseer seed in the Ganga river at Rishikesh near Lakshman Jhula was organized by the Institute under NMCG (National Mission for Clean Ganga), Ministry of Water Resources, River Development and Ganga Rejuvenation to restore and conserve the depleting and endangered fish species like Mahseer on, 23 May 2017. Dr B. K. Das, Director and Dr. R. S. Srivastava, Head of Allahabad RRC were present on the occasion. Shri Sunil Kumar, a nominee of NMCG, Delhi; Professor, Scientists and officials from Gurukul Kangri University, Haridwar, WII, FRI, Dehradun, Forest Dept. Uttrakhand, Fisheries Dept. Uttrakhand, NIH, Haridwar, Central Pollution

Control Board, Central Pollution Research Institute, Haridwar, Ganga Action Plan, Shiv Yog Peeth, Directorate of Coldwater fisheries Research, Bhimtal, NGOs, Scientists of Directorate of Coldwater etc. were also present.



Ranching program of Mahseer seed in the Ganga river at Allahabad and Rishikesh

Another ranching program of IMC was done at Allahabad on 01 August 2017 in collaboration with Directorate of Fishery, Govt. of U. P. and other stakeholders. The seed of Indian Major Carp like Catla, Rohu, Nain in the Ganga River were released under NMCG (National Mission for Clean Ganga). The chief guest of programme, Shri Jai Prakash Nishad, Minister of State, Animal Husbandry and Fishery, U.P. inaugurated the function with lighting the lamp. An awareness programme has also been organized on restoration and conservation of the depleting fish species.

Hon'ble Union Minister Sushri Uma Bharti Visited the Institute

Hon'ble Union Minister of Water Resources, River Development and Ganga Rejuvenation Sushri Uma Bharti visited ICAR-Central Inland Fisheries Research Institute (CIFRI), Barrackpore, Kolkata on 26 May 2017. Honourable minister acknowledged the contribution made by the institute in National Mission on Clean Ganga. She stressed that '*Nirmal Dhara*' of river Ganga can be achieved only when original aqualife (fish, dolphin, etc.) of river Ganga can be restored in their own habitats. She released a poster on fishes of River Ganga. Shri U. P. Singh, IAS, Director General of National Mission on Clean Ganga, Shri B. K. Biswas, Chairman, Ground Water Board and Shri Madhusudan Ghosh, Local MLA were also present on this occasion. Fingerlings of Rohu (*Labeo rohita*) and Catla (*Catla catla*) have been released by her in river Ganga at Barrackpore, West Bengal. Honourable Minister also interacted with the fishers of South 24 Parganas (Sagar Island), Hooghly and Nadia districts of W. B. She appealed all to contribute towards making Ganga clean and incessant. On behalf of ICAR-CIFRI, she distributed fishing nets to fishers of Sagar Island.


Hon'ble Minister distributing net to the tribal fisherman

World Environment Day

The Institute celebrated World Environment Day on 05 June 2017 to generate awareness regarding importance of environment in our lives. The theme for world Environment Day 2017 was "Connecting people to nature". A cruise was organized in the Hooghly River under the leadership of Dr. B. K. Das. He urged all for protecting environment and explained that ecosystems are essential to human life as it provides goods and services upon which human welfare depends. Saplings were planted in the institute residential and office campuses. Rangoli was made by institute staff depicting the role of organisms and their interaction in the ecosystem.


World Environment Day campaign on Hooghly River


Planting saplings

International Yoga Day

The Institute celebrated International Yoga Day on 21 June 2017. The Yoga Session was conducted under the guidance of eminent Yoga experts, Mr. Sujit Ghorei and his group of Yoga Kendra, Barrackpore. The session was conducted based on the Common Yoga Protocol provided by Ministry of AYUSH, Government of India. Around 150 staff members of ICAR-CIFRI and their family attended the program in the morning of 21 June 2017. Earlier, on 20 June 2017 a lecture on "Health benefits of Yoga" was organized for the staff. Other Centres of the institute also celebrated the day.


Yoga session at CIFRI, Barrackpore lawn

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National Fish Farmers' Day

Felicitated fishers/fish farmers

The Institute celebrated National Fish Farmers' Day on 10 July 2017 at its Headquarters. The day commemorates the revolutionary induced breeding technology developed by Dr. Hiralal Choudhury of this Institute. Mr. Ronald Sapa Tlau MP, Rajya Sabha, Mizoram and Chief Guest of the function addressed the farmers and congratulated the team CIFRI for immensely contributing in production enhancement and conservation of natural resources. Dr. P. Das, Former Director NBFGR was also present. A Farmer-Scientist interaction meeting was organized and it was chaired by Swami Visvamayananda ji, Maharaj, Sargachi Ramakrishna Mission. A bilingual bulletin on awareness and sensitization initiative by ICAR-CIFRI, a bulletin on "Fisheries enhancement in reservoirs of MP with special emphasis on MSY" and an extension pamphlet on canal fisheries were released on this special occasion. Around 100 fish farmers from West Bengal, Bihar, Odisha, Jharkhand and Assam participated in the event. Eight fish farmers from different parts of India were awarded at the function. Nets were distributed to the tribal farmers from Burdwan district of West Bengal.


Farmer-Scientist Interact Meeting

Independence Day

The institute celebrated 71st Independence Day on 15 August 2017. Dr. B. K. Das, Director unfurled the tricolor and paid rich tribute to the nation. He recalled achievements made in the last year, including sanctioning of new projects and highlights of the existing projects. He congratulated all the staff for the great achievements. Some of the security staff were decorated for their outstanding services. A cultural programme was also organized. A friendly football match was played in which the trainees from Bihar also participated.


Independence Day speech by the Director; inset : Cultural programme

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Other important events

Dr. J. K. Jena, DDG (FS), ICAR, New Delhi visited the ICAR-CIFRI Vadodara centre and had a talk with the Scientists and other staff of the centre on 12 May 2017

The institute signed a Memorandum of Understanding with M/s Gitanjali for consultancy on establishment of Fish Feed Mill.

The Fish Feed Mill will be contructed at Kalian tala, PO. Bajitpur, PS: Karimpur, District Nadia, West Bengal. Dr B. K. Das, Director from ICAR-

Dr. J. Jena, DDG (FS) inaugurating the recirculatory system at

Sankalp Se Siddhi

The institute observed *Sankalp se siddhi shapath* for making a new India

Prof. Sam Martin, Professor, Fish Physiology, University of Aberdeen delivered Platinum Jubilee lecture on anti viral responses in fish : new investigations using gene editing on 20 June 2017

Other important events contd..

Awareness meeting on e-marketing with Director, DGS&D, Kolkata on 24-04-17

Planting of saplings under *Ganga Briksharopan Saptah* (25-30July 2017) of NMCG programme

Director, ICAR-CIFRI visiting the cage culture site at Chandil reservoir on 10 July 2017.

Important Visitors

Mrs. Ingar Midtkandal, Norwegian embassy is in discussion with the Director and Head, FREM Division

Mr. Tom House, Mr. David Wilkes of ARUP in discussion with CIFRI Official on collaboration on fish pass

Dr. C. Suvarna, IFS, Commissioner of Fisheries Govt. of Telangana visiting the Institute on 10 Aug 2017

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Tribal Sub-plan activities

TSP activities are simultaneously implemented in the states of West Bengal, Odisha, Madhya Pradesh, Karnataka and Kerala to improve the livelihood and nutritional security of tribal fishers. Allahabad Regional centre of ICAR-CIFRI is focusing on the nutritional security and livelihood development of tribal fishers of Luni wetland at Rewa district of MP. Fish seed raising in pen and stocking of advanced fingerling for production enhancement is the major focus of this programme. Fisheries activity in the wetland is managed by "Jaagaruk Machhua Sahkaari Samiti Maryadit -KhatakriKhurd". The centre, led by Dr. B.K. Das, Director conducted awareness camp on 04 April 2017. Fishing nets were distributed among tribal fishers of the society by the Director. Dr. R. S. Shrivastava, Head, Allahabad RRC, Dr. B.P. Mohanty and the staff of Allahabad Centre also interacted with the tribal people. The team felt that enclosure culture of fishes hold a great promise for harnessing the potential of ecosystem, employment generation and poverty alleviation of rural tribals.



1. View of Loni wetland 2. Awareness program on wetland management 3. Fish net distribution to tribal fishers

Sagar Island, also known as Ganga Sagar, is a part of Indian Sunderbans rich in Mangrove swamps, water ways and small rivers. Tribals, particularly the Santhal community, have significant share in total population. A fish harvest mela was organized by the institute on 14 June 2017 and a total of 861 kg brackish water as well fresh water fishes were harvested from 0.662 ha. Ten families could earn more than Rs. 2 lakhs in the current year. A sensitizing meeting was also organized in which local MLA, local Sabhapati, Karmadhaksya, Director, ICAR-CIFRI, Incharge Kolkata RS of ICAR-CIFRI and about 100 nos. of villagers participated.

Fish harvest at Sagar Island

Another fish harvest mela was organized on 24 August under the leadership of Dr. B. K. Das, Director, at Kalitala, Hingalaganj, Sundarban area of West Bengal. Kalitala is a remote socio-economically poor tribal dominated village of Indian Sundarban area, vulnerable to flood and cyclone. ICAR-CIFRI has initiated livelihood support programme by introducing canal fisheries development through technical support, inputs and capacity building programme. The canal of Kalitala is around 850m x 30m in area. A total of 6 tons fishes mainly catla, rohu and mrigal were harvested from the canal during this year. A total of 90 tribals were involved in this programme. On the occasion, a workshop-cum-awareness programme was organized in which Dr. B. K Das discussed fish disease and nursery pond management.

A team of ICAR-CIFRI conducted an interaction meeting at Gardanmari village situated at Bhatar Block of Burdwan district

Fish harvesting at Kalitala

Diseases management lecture by Dr. B.K Das

Interaction meeting at Gardanmari, Burdwan

Water quality analysis at Gardanmari, Burdwan

of West Bengal on 12 September 2017. Approximately 650 tribal households concentrated in the village, majority of them are tribals.

A sample survey showed that about 45% of the population is illiterate and about 65% are landless labourers. A wetland (Adivasi dighi) of around 10 ha area is the major fishery and water resource for them. Gardanmari Adibasi Dighi Unnayan Samiti is striving for developing fisheries in that wetland. The water quality parameters were tested at the site and sediment samples were collected. The institute also provided fish feed to the Society for enhancing production.

The institute also initiated TSP activities at Kalo reservoir and MIP Rajabandha of Mayurbhanj district of Odisha. Mayurbhanj ranks 15th among the most underdeveloped districts of India. 60% of the population of the district is tribals and the district is bestowed with vast water resources including 12 reservoirs with a mean water area of 4407 ha. The ICAR-CIFRI team, led by the

1. Director CIFRI along with DFO Mayurbhanj at Kalo Reservoir 2. Interaction with fishers of MIP Raja Bandha

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Glimpses of *Swachh Bharat* activities

Inauguration of *'Swachhta hi seva'* campaign on 15.09.17

Planting of saplings at Hingalganj, Sundarbans

Swachhta Shramdan at Barrackpore on 17.09.17

Cleaning campaign at Mangal Pandey park, Barrakpore on 01.10.17

Samagra Swachhta Diwas by Barrackpore staff on 24.09.17

Sarwatra Swachhta Diwas by Barrackpore staff on 25.09.17

Activities under *Swachhta Pakhwada* at Guwahati RRC

Swachhta activities by Allahabad RRC

Swachhta hi seva shapath at Bangalore RRC

Cleaning activities at Hesarghatta lake during *Swachhta hi seva* by Bangalore RRC

Swachhta hi seva shapath at Kochi R.S. on 15.09.17

Outdoor Swachhta campaign by Kochi R.S. on 23.09.17

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Swachhta activities at Vadodara RRC

Closing ceremony of *Swachhta hi seva pakhwara* on 02.10.17 at Barrackpore

Flash back.....CIFRI @ 2000-2010

A new Office-cum-laboratory building at Guwahati Regional Centre of the Institute was inaugurated on 6 November, 2001 near Assam State Secretariat. The 16,400 sq ft ready made building complex was purchased from the HOUSEFED, a State owned undertaking. Newly constructed Paryavaran Bhavan, Administrative wing of the Institute was inaugurated by Sri. Hukumdeo Narayan Yadav Hon'ble Union Minister of State for Agriculture on 02 April, 2000 at Barrackpore Head Quarters.

Sri S. K .Sinha, H.E. Governer of Assam unveiling the plaque commemorating inauguration of the new building at the Northeastern Regional Centre of CIFRI, Guwahati.

Sri. Hukumdeo Narayan Yadav Hon'ble Union Minister of State for Agriculture, inaugurating the Paryavaran Bhavan of the Institute at Barrackpore Head Quarters

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Since February, 2009 the Institute research activities have been organised under three divisions: Riverine Ecology and Fisheries, Reservoir and Wetland Fisheries and Fisheries Resource and Environmental Management. Dr. M. Sinha, Dr. K.K. Vass and Prof. A.P. Sharma led the institute as regular Directors during the decade. The annual expenditure of the institute was Rs. 1055 lakh, comprising Rs. 368 lakh under plan and Rs. 687 lakh under non plan in 2000-01. The expenditure rose to Rs. 419.67 lakh under plan and 1807.67 lakh under non-plan totalling Rs. 2227.34 lakh during 2009-10.


Dr. M. Sinha


Dr. K. K. Vaas


Prof. A.P. Sharma

The research programmes of this decade were designed with major thrust on ecosystem research involving resource base assessment, ecology, biodiversity, fish stock evaluation including yields and environment monitoring and its management. Detailed studies were carried out for assessing production potential and fisheries resources of reservoirs, floodplain wetlands and rivers; assessment of ecology and fisheries of the Hooghly, Narmada, Mahanadi and other estuaries along with the associated wetlands; monitoring of environmental and fishery status of river Ganga and Yamuna; genetic study of hilsa population; monitoring of aquatic pollutants and standardization of various parameters for monitoring fish and prawn health and controlling disease outbreak.

Map of water bodies of Vaishali, Bihar using remote sensing data

The issues related to resource assessment on GIS format was also addressed since middle half of this decade. The modern tools of remote sensing were used to develop digitised maps of inland water bodies. The research was also directed towards standardizing and application of the enhancement tools to improve the fish productivity in reservoirs and wetlands. Cage culture experiment has been continued to convincingly demonstrate the possibilities of fish production in cage from an open water system. Pen culture system has also been identified as one of the reliable means for solving the problem of raising healthy fingerlings of desired size.

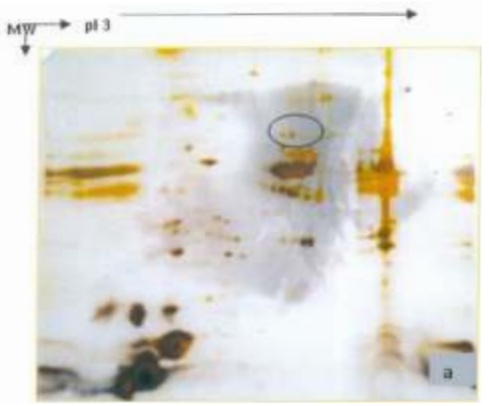

Cage culture experiment

In the context of changing scenario of inland environment and climate change, the institute was involved actively in monitoring of ecosystem health and assess the impacts on fish stocks at molecular, physiological and community levels. In the process, a perceptible shift in geographic distribution of the warm water fish species *Glossogobius giuris, Puntius ticto, Xenentodon cancila, Mystus vittatus* towards the colder stretch of the river Ganges around Haridwar has been recorded in 2008-09.

Proteome map of muscle and lens proteins of Indian major carp *Labeo rohita* were generated for the first time in 2009-10. 2-D proteome map for *Rita rita* lens crystallins was also generated. The contamination of inland aquatic food chain, including fishes, by various toxicants and their degradation were also looked into. Towards ecosystem health monitoring, bioindicators were developed at biochemical, physiological and community levels in 2005-06. Application of Health Assessment Index (HAI) in fish of the stressed and non-stressed *beel* in 2006-07 showed HAI as a useful index for rapid evaluation of fish health in *beels.* Monitoring of pesticides in river Ganga showed 4,4'-DDTs was present in concentrations higher than its permissible limits of EPA (USA) at all the sampling sites in 2005-06.

Data were being collected and maintained on fish catch collected at various centres of the Institute from different inland water systems. An estimated catch of 44601.4 tonnes (t) was netted out from the Hooghly estuary and the catch at Digha landing centre amounted to 28774.9 t (combined catch being 73376.3 t) during the period February 2000 to January 2001. Hilsa catch during 2000-01 from Hooghly river was 9780.8 t. Hilsa is the major component of estuarine fishery contributing 48% of the total yield from Hooghly estuary and 32% of the combined catch of Hooghly estuary and Digha.

A view of Industrial effluent releasing tunnel from Durgapur Industrial Complex



Proteome map of muscle proteins of *Rita rita*

Hilsa catch from Hooghly estuary and Digha

Fish catch database

Serious attention was given to transfer of technology, internal and external human resource development, public awareness programmes, establishment of linkages, and institution building activities. The institute also took initiative to study the livelihood system of fishermen dependent on inland water bodies. Various attempts were made to create awareness about biodiversity and ecosystem conservation among the fishers who depend upon the fishing activities along rivers and estuarine systems. Demonstrations were made on various fishery enhancement techniques to different user groups operating in wetlands.

In addition to many technical bulletins, books and book chapters, around 400 research papers have been published by the institute during the decade.

OFT on Rice-cum fish culture

Awareness campaign on fish conservation

Owing to excellent research and extension works, the staff of the institute got awarded and recognized nationally and internationally. During the decade some scientists got fellowship of the coveted professional societies. Dr. K. K. Vass of the National Academy of Agricultural Sciences; Dr. R.S. Panwar of the Indian Society of Agricultural Chemists; Drs. A.K. Laal, Shree Prakash, B. K. Singh of Bioved Research Society; Drs. V. V. Sugunan and R.N. Seth of Zoological Society, Kolkata; Drs. B.P. Mohanty, R.N. Seth and P.K. Katiha of the International Society for Ecological communication are some of the examples.

Dr. K. K. Vaas, Director CIFRI being conferred Fellowship of NAAS by Dr. M. S. Swaminathan

The Fisheries Technocrats Award received by Dr. V. V. Sugunan

Dr. R. N. Seth, was also conferred with the Scientist of the Year Award in the field of fisheries by Bioved Research Society in 2004. Dr. V. V. Sugunan was awarded the Fisheries Technocrats Forum Annual Award for the year 2001and Environmental Conservators Excellency Gold Medal by the Nature Conservators, Muzaffarnagar. Dr D. Debnath and Sona Yengkokpam won the Young Scientist awards at the 8th Indian Fisheries Forum.

The ICAR-CIFRI stall was selected as “The Best Exhibitor of Gourami Variety” in the Aqua Show 2006 Competition held at Kaloor, Kochi. In the sports arena, Sri P. Muraleedharan and Sri M. Roy were adjudged best athletes couple of times in ICAR Zonal Sports.

Governor of Jharkhand honouring Dr. R. N. Seth

Sri P. Muraleedharan and Sri M. Roy

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vuql/kku miyfC/k;k¡

Xkxk unh d e/; lfupy Hkkx e ykfc;k jkfgrk d iFke ckj ifjiDo gku d le; m ldh yckb e fHkUurk

Ykfc;k jkfgrk itkfr dh 50 ifr'kr ifjiDo ,o v.Mk'k; okyh eNfy;k dh yckb dk iFke ckj ifjiDo gku okyh eNyh dh yckb dk ekud ¼L_{m50}½ ekuk tkrk gA o"k 2009 l 2013 d nkjku eNfy;k d ,df=r ueu ;g crkrk g fd xxk unh e Ykfc;k jkfgrk d iFke ckj ifjiDo gku d le; budh yckb lkekU;r% 550 fe0eh0 gkrk g ij fofHkUu yfMx dUnk l idMh xb eNfy;k dh yckb vyx&vyx ikb xbA uo}hi ,o QjDdk {k=k e ifjiDo eNfy;k dh yckb yxHkx 500 fe0eh0 tcfd iVuk vkj bykgkckn e Øe'k% 578 fe0eh0 vkj 575 fe0eh0 ikb xb tk ;g fn[kkrk g fd xxk d fupyh {k=k e bl e/; {k= dh rqyuk e eNfy;k dh ifjiDork igy gkrh gA

pnj] ,l- ,y 1999 d vuqlkj xxk unh dh eNfy;k 3 l 4 o"k e ifjiDo gk tkrh g rFkk ,d ifjiDo eNyh dh yckb 580 fe0eh0 gkrh gA o"k 2009 l 2013 rd d vkdM ;g fn[kkr g fd bl nkjku eNfy;k d ifjiDo gku e 3 l 4 o"k dk le; yxk tcfd o"k 1999 e leku vkdkj okyh eNfy;k doy 2 o"kk e ifjiDo gk xb FkhA xxk unh d fupyh {k=k dh ifjiDo eNfy;k dh yckb ryukRed rkj ij de n[kh xb ftl dk dkj.k Fkk& eNfy;k fo'k"kdj vifjiDo eNfy;k dk vR;f/kd nkguA vkdMk d vuqlkj] o"k 1999 e eNfy;k doy 2 o"kk e ifjiDo ¼500 xkO½ gkrh Fkh tcfd oreku e bud ifjiDo gku dh vof/k 3 o"k gA

oh- vkj- lqj'k] ,e- uLdj] ,e ih- ckãuh] ch- d- cgjk] nccr iMk] Mh- d- eh.kk] d- d- ykyk] t- e[kth] Mh- d- fcLokl] okb- vyh ,o ,- d- tkuk

xxk unh d e/; {k= e gd ,oa ykbu tky }kjk cgeRL;;u

xxk unh foLrkj e mRrj in'k d Q:[kkckn] dUukt] dkuij rFkk bykgkckn ftyk e gd ,o ykbu tky }kjk cgeRL;;u dk i;kl fd;k x;k gA bl i)fr e ,d l pkj eNvkj fx;j tky dk pyk rk gA bl e ,d e[; ykbu tky dk {kfrt vkdkj e ckl d [kHk d nkuk Nkj ij ck/k fn;k tkrk gA bl e[; ykbu tky e 6 l 10 l0eh0 okyh db vU; ykbu tky rFkk gd tkyk dk 1 ehVj d vrj ij ck/k fn;k tkrk gA bu ykbu tky rFkk gd tkyk dk LFkkuh; uke *tkvkj* ¼Joar½ gA lHkh ykbu ,o gd tky ikfyikfyfu vkfn l cu gkr g ij e[; ykbu tky d /kkx vf/kd ekV gkr gA e[; ykbu tky dh yckb 16 l 100 eh0 rd dh gkrh gA e[; ykbu tky dh yckb 16 l 100 eh0 d chp rFkk gd dh l[;k Hkh 16 l 100 d chp gkrh gA

e[; ykbu tky dh yckb 20 eh0 l vf/kd gku ij db ckl d [kHk dk unh e yxk fn;k tkrk gA gd tky dPp ykg dk cuk gkrk gA eNvkj pkjk d :Ik e dpvk rFkk NkVh ifUV;kl eNfy;k dk i;kx djr gA fx;j tkyk dk i;kx fNNy ty{k=k rFkk ekuluu d nkjku de ty cgko okyh LFkkuk ij fd;k tkrk gA yxHkx 4 l 6 ?kVk d eRL;;u d i'pkr 3 l 4 fd0xk0 eNfy;k feyrh g ftue dVfQ'k ¼jhrk jhrk ,o feLVl itkfr;k½ rFkk by itkfr;k ¼eLVklEcl vkjeVl½ ie[k gA

,l- lh ,l nkl] vcl kj vkye] Mh- ,u- >k] t- dekj] oh- vkj- Bkdj] vkj- nkl] oh- dekj] d JhokLro] ,l- d- JhokLro] ,l- d oek] ,l- d- feJk] ,p- vk- oek ,o vkj- ,l- JhokLro

xxk unh d e/; {k= e Vkbdk xLVj duk ¼gfeYVu] 1822½ dh mifLFkfr

xxk unh d e/; {k= e Vkbdk xLVj duk ¼gfeYVu] 1822½ itkfr dh ,d eNyh dk ujkjk e n[kk x;k gA bldk ipfyr uke guh xkjkeh rFkk LFkkuh; uke [kkfy lk@[kLlk gA vkb;Ih,u d fjikV d vuqlkj bl itkfr dk vfLrRo lfj{kr gA Vkbdk xLVj thul le e ;g itkfr lcl NkVh vkdkj dh gkrh gA ;g eNyh ihy 'kgn d jx dh gkrh g rFkk bld i"BHkkx e dkyh /kkfj;k gkrh g tk bld vk[kk rd Qyh gkrh gA ;g eNyh ehBk ty e ?ku ik/kk rFkk de cgko okyh ty{k=k e okl djrh gA Vh- duk lokHk{kh gkrh g rFkk NkVh eNfy;k] dhMk rFkk trqlyodk dk [kkrh gA bl eNyh dh mÙkj thfork d fy; vif{kr tyh; dkjd g% ty dk rkieku& 24° l-x-] ih,p& 7-6] ikjnf'krk& 37-0 l-eh-] ?kfyr vkDlhtu& 7-28 ih ih ,e] fof'k"V pkydrk& 202 μS/cm] dy ?kfyr BkI rRo& 116-4 ihih,e rFkk {kkjh;rk& 96 ihih,eA

vcl kj vkye] ,l- lh ,l nkl] thrUn dekj] Mh- ,u- >k] vkj- ,l- JhokLro] fc- d- nkl] ,l- d oek] ,p- vk- oek ,o ,l- d- feJk

xtjkr d uenk Tokjune[k d nynyh {k= e ddMk ikyu vk; dk ,d lk/ku

xtjkr d uenk Tokjune[k d nynyh {k= e ik;h tku okyh ddMk itkfr] Ldkbyk lj jVk ¼Qkldy 1775½ d ikyu dk vk; miktu d lk/ku d :Ik e n[kk tk jgk gA bl itkfr dk LFkkuh; ipfyr uke *dkjkpyk* gA ;g itkfr bl Tokjune[k d e/; rFkk fupy Lrj e fuEu Tokj d le; ij o"kHkj fo'k"kdj 'khrdky e vf/kd ik;h tkrh gA ;g n[kk x;k g fd exko {k= e ddMk dk idMuk vklku gkrk gA LFkkuh; eNvkjk }kjk ykg l r;kj dh xb ikjifjd eRL;;u midj.k *xjh* bu ddMk dk idMu d fy; lVhd gkrk gA bl fx;j tky l eNvkj ,d fnu e 1 l 5 fd-xk- rd ddMk idMr g tcfd gkFk l ,d fnu e doy 0-5 l 3-0 fd-xk- ddMk gh idMuk lHko gk ikrk gA bl Tokjune[k e Ldkbyk ljVk d vykok ddM dh Ldkbyk VkUdcfjdk ¼Qcfl;l] 1798½ itkfr Hkh ikb tkrh gA ;gk ddMk dk cxuV] LVd uV rFkk fxyuV }kjk Hkh idMk tkrk gA lkekU;r% ddM 85 l 700 xk0 rd ik; tkr g vkj budk eY; bud vkdkj d vk/kkj ij r; gkrk gA o"k 2014&15 d nkjku bl Tokjune[k l dy 40 Vu ddMk dk mRiknu gvk gA budk ckt kj eY; :0 150&200 ifr fd-xk- ,o :0 200&300 fd-xk- budh miyC/krk d vuqlkj gkrk gA

दिवाकर भक्ता, डब्लू आनंद मेती, वैशाख जी, एस. कांबले, जे. के. सोलंकी, एस. के. दास एवं बि. के. दास

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ugj {k= ekfRL;dh dk fodkl & lhjnjou {k= e|LFkkuh; le|nk; d|fy;|vk; miktu dk lkj

lUnjou e ugj lk/ku {k= 907-33 g0 {k= e Qyk gvk g ftle ekfRL;dh fodkl dh vkj lHkkouk; gA lLFkku u lkxj }hi d enuxt e HkVdhekjh rFkk fo'kky[kh [kky e eNyh ikyu dh lHkkoukvk gr lo{k.k fd;k gA HkVdhekjh [kky 3-5 fd-eh- ych rFkk gFkfu;k&nokfu;k unh d lkFk tMh gb gA bl ugj dh vklr xgjkb 1-25 eh0 rFkk pkMkb 20 eh- gA fo'kky[kh [kky 1-5 fd-eh- ych rFkk gxyh unh d lkFk tMh gb g vkj bldh xgjkb HkVdhekjh [kky l vf/kd] 2-5 eh0 rFkk pkMkb 25 eh- vkdh xb gA bu nkuk ugjk e ikb tku okyh eRL; itkfr;k g& *,ukcl VfLVfMul] ifFk;k fVDVk] ifUV; l lkQkj] pUuk idVVl] ,fECyQfjxkMku ekyk] feLVl xfy;k] edkuFkl* leg] *Vkbdkx LVj* leg] pUnk leg rFkk NkVh >hxk itkfr] *eØkcfd;e bfDoMul* vkfnA ;gk yxHkx 79 ifr'kr fuoklh eRL;;u dk; l tMg rFkk bu nkuk ugjk ij yxHkx 380 ifjokjk ¼ HkVdhekjh [kky & 130 ifjokj½ rFkk fo'kky[kh [kky & 250 ifjokj½ dh vkthfodk tMh gb gA bu ugjk e o"k d dN eghu ?kj e eRL; ikyu dk vk; miktu d odfYid lkr d :lk e viuk;k tk ldrk gA

vpuk flUgk] ih xkxkb] ,l d nkl] ,e jkeVd] Vh rk;x] ekul ,p ,e ,o vi.kk jk;

vkfM'kk d|nkjtx tyk'k; e|ekfRL;dh lo/ku gr|bldh ikfjfLFkfrdh ,oa ekfRL;dh dk vkdyu

vkfM'kk d vkxy fty d nkjtx tyk'k; e ,d lo{k.k fd;k x;kA bl tyk'k; dk ty ckyh unh l tfMr nk ugjk] fyxkjk rFkk erkfy;k l ikIr gkrk gA bl fNNy tyk'k; dk vklr lrgh {k= 530 g0 g rFkk bl ij dyk ikrk ikFkfed ekfRL;dh lgdkjh lfefr l ;Dr 150 eNvkjk ifjokjk dh vkthfodk fuHkj djrh gA ;gk ekfRL;dh cgr;k futh Lokfeo d vrxr fd;k tkrk gA ekfRL;dh ,d o"k e nk ckj] flrcj&vDVcj l ekp&viy d eghuk e bfM;u etj dki rFkk >hxk itkfr] *eØkcfd;e ekydkelkfu* dk fd;k tkrk gA

bl tyk'k; e lo{k.k d nkjku 16 Hkkfrd ,o jlk;fud ikpyk & ty dh xgjkb] rkieku] ih,p] ?kfyr vkDlhtu] fof'k"V pkydrk] eDr dkcu MkbvkDlkbM] VhMh,l] dy dBkjrk] dfY'k;e] eXuhf'k;e] Dykjkb M] ukbVV] QkLQV ,oflfydV dk fo'y"k.k ekfRL;dh lo/ku dk /;ku e j[k djfd;k x;kA bl tyk'k; e iknilyodk dh 42 itkfr;k rFkk trlyod dh 15 itkfr;k dh mifLFkfr n[kh xb A eNfy;k dh 28 itkfr;k dk ik;k x;k rFkk ;gk ekulu d le; eRL; mRiknu 342 fd0xk0 vkdk x;k g ftle bfM;u etj dki 76 ifr'kr] NkVh n'kh eNfy;k 11 ifr'kr rFkk >hxk itkfr;k 5 ifr'kr nt dh xbA o"k 2016&17 d nkjku bl tyk'k; dh mRikndrk 200 fd0xk0 ifr g0 vkdh xb gA

fy;kuFkeyb;kj ih ek>h] Vh rk;x] ,-d-cjkj ;-d-ljdkj] l/;k d-,e-] leu dekjh] fe"kky ih-] th-dukVd] ,e-,-glu ,o ,-d-nkl

mRrj in'k d|tkjx|tyk'k; e|ekfRL;dh dh fLFkfr ,oa lHkkouk;|

mRrj in'k d fetkij fty e tkjxk unh ij tkjxk tyk'k; dk fuek.k o"k 1956&58 e fd;k x;kFkkA bl tyk'k; dk vU; ufn;k tl] ipokfguh] defg;k] cjkgh rFkk eufe;k l ty iklr gkrk gA bl tyk'k; dk {k= 3108 g0] dpeUV {k= 40145 g0 rFkk ty/kj.k {kerk 150-7 D;fcd eh0 gA bl tyk'k; e 23 tujk] 13 Qfeyh rFkk 7 vkMj d 32 eRL; itkfr;k rFkk lyod dh 25 itkfr;k ¼ DykjkQkb lh& 10 itkfr;k ½ dk nt fd;k x;kA o"k 2007 e bl tyk'k; dk eRL; mRiknu 31-85 Vu Fkk tk o"k 2014 e c<dj 173-1 Vu gk x;kA bl tyk'k; ij dy 100 l 150 eNvkjk ifjokjk dh vkthfodk fuHkj djrh gA nt dh xb eRL; itkfr;k e lcl vf/kd yfc;k jkfgrk n[kh xbA vklru dy ikjfHkd mRiknu 288 fe-xk- dkcu@?ku eh0@?kVk nt fd;k x;kA idk'k l'y"k.k {kerk ¼0-18 ifr'kr½ dk n[kr g; lHkkfor mRiknu 127 fd-xk-@g0 vkdk x;k g tcfd oreku eRL; mRiknu 40-24 fd-xk-@g0 nt fd;k x;kA bl v/;;u l ;g irk pyrk g fd itkfr lo/ku ,o mUur ic/ku mik;k }kjk bl tyk'k; d eRL; mRiknu e of) dh tk ldrh gA

vcl kj vkye] thrUn dekj] fot ; dekj ,o ;-d-ljdkj

xkfoUn lkxj ,oa ikbx tyk'k;k|e|fitjk ikyu rduhd dk i;kbx

o"k 2016 d nkjku lLFkku u ekfRL;dh foHkkx] fgekpy in'k ljdkj d lg;kx l xkfoUn lkxj ,o ikx tyk'k;k e fitjk ikyu rduhd dk i;kx ikjHk fd;k gA bld fy; *ixkfl;kukMku gkbikFkyel* dh cMh vxfydkvk dk ¼6250 vxfydk;@fitjk½ 48 ,pMhihb l cu rjr g; fitjk ¼6 eh-× 4eh-× 4eh-½ e j[kk x;kA bu lpf;r eNfy;k dk fu;fer rkj ij fujh{k.k fd;k x;k rFkk bUg iFke rhu eghuk rd bud 'kkjhfjd Hkkj d 32 ifr'kr v'kkf/kr ikVhu l cu ,o ty e ugh Mcu okyh iyV Hkktu fnu e rhu ckj fn;k x;kA rhu eghuk d ckn fnu e nk Ckkj Hkktu fn;k x;k rFkk bl iyV Hkktu e v'kkf/kr ikVhu dk ifr'kr 28 ifr'kr dj fn;k x;kA ikp eghuk d ckn ikx vkj xkfoUn lkxj tyk'k;k dh lpf;r eNfy;k dh vklr yckb ,o vklr Hkkj Øe'kk 35.11 ± 1.97 l-eh- ,o 642.6 ± 107.28 xk- vkj 27.58 ± 4.8 l-eh- ,o 323.8 ± 146.08 xk- nt fd;k x;kA iklr ifj.kke ;g crkr g fd fgekpy in'k rFkk fgeky;h {k= d tyk'k;k e fitjk ikyu eRL; mRiknu of) lHkkouk vf/kd g rFkk bl l eNvkj vk; miktu Hkh dj ldr gA

Vh- rk;x] ,-d-nkl] ,e- ,p jkeVd] fc-d-nkl ,o ;-d-ljdkj

rfeyukMk|d"k.kkfxfj tyk'k; e|frykfi;k eNyh dk mRiknu

rfeyukM dk d"k.kkfxfj tyk'k; ,d e/;e vkdkj dk tyk'k; g ftldk ,Q vkj ,y 1234 g-gA jkT; ljdkj ekfRL;dh foHkkx l iklRk vkdM ;g crkr g fd o"k 1995&2016 d nkjku ;gk frykfi;k itkfr;k dh i/kkurk FkhA tykb 2017 d lo{k.k d vulkj] bl tyk'k; e dy 11 eRL; itkfr;k dk nt fd;k x;k gA tyk'k; e lpf;r etj dki

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itkfr;k e l 80 ifr'kr eRL; mRiknu frykfi;k¼vkfj;kØkfe l ukbykfVd l & 58% rFkk vk- ek lkfEcd l & 22%½ rFkk 20% NkVh n'kh eRL; itkfr;k dh gA vr% eNfy;k d lp;u l bl tyk'k; dh ekfRL;dh ij gku oky iHkkok dk vkdyu fd;k tkuk pkfg;A

t luk ih- d-] jke;k oh ,y-] f lfcuk eky] v t ; lkgk] ihFkk ifuDdj ,o ,e- dkfFkd;u

vle d|chyk d|eRL; mRikndrk ij lp;u i)fr rFkk unh; liidldk iHkko

o"k 2012&17 d nkjku vle d rhu chyk dh ikp itkfr;k dh l;pu vof/k rFkk ufn;k l bu chyk d ;Dr gku lc/kh v/;;u fd;k x;kA ; rhu chy g& ldnky&lk:ckjh ¼fcuk lp;u okyh [kyk chy½] ej chy ¼vf/kd lp;u ?kuRo okyh ekleh [kyk chy] lp;u ?kuRo] 2500 l 3000 vxfydk; ifr g0½ rFkk neky chy ¼e/;e lp;u ?kuRo okyh cn chy] lp;u ?kuRo] 1500 l 2000 vxfydk; ifr g0 chy½A lcl vf/kd eRL; itkfr;k ¼34 itkfr;k½ ldnky&lk:ckjh chy e nt dh xbA bld ckn neky ¼30 itkfr;k½ ,o ej chy ¼26 itkfr;k½ e nt dh xbA lpf;r eNfy;k dh itkfr;k dk ikIr eRL; mit e fo"k"k Hkfedk gkrh g D;kfd e 70 l 75% lpf;r eNfy;k rFkk 'k"k n'kh okbYM eRL; itkfr;k n[kh xb gA vlpf;r chyk e NkVh n'kh eRL; itkfr;k e 85 ifr'kr ifuV; l itkfr dh eNfy;k dk nt fd;k x;kA ;g n[kk x;k g fd vf/kd lp;u ?kuRo oky chy e vkIr eRL; mit vf/kd gvk g t l ej chy dk mRiknu 1385 fd-xk-@g-@o"k nt fd;k x;k tcfd e/;e lpf;r] neky chy dk mRIknu 924 fd-xk-@g-@o"k rFkk li.k vlpf;r ldnky&lk:ckjh chy dk mRiknu 487 fd-xk-@g-@o"k nt fd;k x;k gA oreku v/;;u ;g crkr g fd ufn;k l tM jgu oky chyk e eRL; itkfr fofo/krk vf/kd ikb tkrh g vkj lijd vkgkj ifr bdkb eRL; mit of) e lgk;d gkr gA

, l ;xkie] ch d HkVVkpk;] Mh ncukFk] iuo nkl] , d ;kno] d d ljek] ,u 'kek] , l ckjkg] , ddkrh ,o ,u , l flg

Ek?kky; d|rhu vuUof"kr vkn{k=k|dh eRL; fofo/krk

o"k 2015&16 d nkjku Ek?kky; d rhu vuUof"kr vkn{k=k] ckjk chy] dkVyh chy rFkk defyxko dh eRL; fofo/krk dk v/;;u fd;k x;kA bue l ckjk chy ,o e/;e vkdkj ¼80 g0½ d [kyk ¼o"kHkj½ chy {k= g rFkk if'pe xkjk fgy fty e fLFkr gA dkVyh chy ,d NkVh chy ¼36 g0½ g tk o"k d dN eghuk e [kyh gkrh g rFkk ; nkuk chy n: ,o njuh ufn;k l tMh gb gA defyxko chy dk lp;u ,o ixg.k nkuk idkj dh ekfRL;dh d fy; mi;kx fd;k tkrk gA ;g chy xkjk fgYl Lok;Rr ftyk ifj"kn dk iVV ij fn;k x;k gA oreku v/;;u e fQu EkNfy;k dh ckjk chy e dy 65 itkfr;k] dkVyh chy e 54 itkfr;k rFkk defyxko e 57 itkfr;k dk nt fd;k x;k gA bu fQu eNfy;k e lcl vf/kd lkbfifuQke vkMj dh eNfy;k dh mifLFkfr n[kh xbA bld ckn flyfjQke rFkk ifIQke vkr gA lkbfifuMk Qfeyh dh vf/kd itkfr;k dh mifLFkfr nt dh xbA ckjk chy e ;nkdnk fgyIk eNyh dk Hkh n[kk x;k gA vr% ;g vueku yxk;k tk jgk g fd bl chy e fgyIk eNyh dk vfHkxeu cãi= unh l gvk gkA lHkh chyk e ifrcf/kr fon'kh itkfr] Dyfj;l xjhihfu;l dk Hkh LFkkuh; eNvkjk }kjk n[kk x;k gA

iuo nkl] ch d HkVVkpk;] , d ;kno] Mh ncukFk] , l ;xkie] d d ljek] , ddkrh ,o fc- d- nkl

vkn{k=k|d lc{k.k d|vuIkkj] if'pe cxky d|vkn{k=k|e|ekfRL; dh lo/ku gr|ikyu ekfRL; dh ,d vkn'k ikyu

o"k 2016&17 d nkjku if'pe cxky d Hkkxhjfkh&gxyh foLrkj d uk vkn{k=k] ioLFkyh] ckMkdkcyk] dfVxxk] fc".kij] pyfr;k rFkk rhLrk&rkjIk foLrkj d u;kpkjk] xkj[kk] lkgcxt vkj flrkb vkn{k=k dk lo{k.k fd;k x;k ftIl bu vkn{k=k dh ikfjfLFkfrdh] ekfRL;dh] lLFkkxr lfo/kk; rFkk inRr rduhdk d ckj e foLrr tkudkjh iklr gk ldA ; vkn{k= eNvkjk dk vk; mik tu d volj inku dju d lkFk ikfjfLFkfrdh lk;Vu] flpkb vkfn lok; Hkh inku djr g tcfd vU; vkn{k= doy ekfRL;dh gr mi;kx fd; tkr gA eYVhMkbeU'kuy Ldfyx i.kkyh ;g bfxr djr g fd nk vyx&vyx cflu e fLFkr vkn{k=k dh ikfjfLFkfrdh; x.k e fHkUurk gkrh g] ij dfVxxk ,o u;kpjk vkn{k=k d ikfjfLFkfrdh; x.kk e lekurk; ikb xb gA

v/;;u ;g crkr g fd if'pe cxky d xkok d vf/kdrj vkn{k= ikni ,o ik"kd rRok l Hkjij gkr g ij 'kgjh {k=k d vkn{k=k e ;g de ik;k tkrk gA ikyu vk/kkfjr ekfRL;dh rduhd dk ipyu vf/kd g ij ble vHkh Hkh l/kkj dh vko';drk g D;kfd cgr l vkn{k=k dh mRiknu vk'kk d vu:i ugh gvk gA eNfy;k d vf/kd nkgu l n'kh eRL; itkfr;k dh miyC/krk e deh n[kh tk jgh g] vr% bld fy; tkx:drk Qyku dh vko';drk gA

,e , g lu] ek0 v¶rkcÌhu] v:.k ifMr] Mh- d- eh.kk] l/;k d- ,e-] fe"kky ih-] leu dekjh] fy;kuFkeyb;k] ih ek>h] ;- d ljdkj ,o fc- d nkl

Mh,u, ,xkjkl tly gr|byDVkQkjfll&lg&LVfux midj.k

,xkjkl ty gr byDVkQkjfll ,d fu;fer i;kx dh tku okyh rduhd g ftldk i;kx ij fo'o e U;fDyd ,flM dk iFkd dju d fy; fd;k tkrk gA bl ty dk iokfgr dj bldk LVfux fd;k tkrk g rFkk fofHkUu midj.kk ,o ifrfØ;k'kh n0;k d lkFk vif{kr ifj.kke iklr fd;k tkrk gA bl ifØ;k e U;fDyd ,flM dk {kftr ty byDVkQkjfll }kjk bud vkdkj d vulkj foHkktu fd;k tkrk g rkfd budk LVfux }kjk n[kk tk ldA ;g ifØ;k vR;Ur gh tfVy ,o vljf{kr g D;kfd bl ifØ;k e vud pj.k gkr g rFkk ble gkfudkjd jlk;uk dk i;kx gkrk gA vr% ty byDVkQkjfll] LVfux rFkk ifrfcfcr dju d fy; ,d ljf{kr] lLrk] le; dh cpr dju oky midj.k r;kj fd;k x;k rFkk bldk ijh{k.k fd;k x;kA ;g u;k midj.k ipkyu e vR;Ur gh ljy g rFkk bl io midj.kk dh lgk;rk l dk; fd;k tkj ldrk gA ,xkjkt {kftr ty byDVkQkjfll d ljy ipkyu gr ,d ykHkdjh midj.k gA

ioh.k ek;
mPp rkieku e|ifUV; l lkQkj d|xkukM mRRkd d|thu ,Dli|'ku dk fj;y Vkbe ihlhvkj fo'y"k.k gr|mi;Dr jQjU l thu dk fu/kkj.k

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;g n[kk x;k g fd ty d mPp rkieku l eNfy;k d xkukM d fodkl ij ifrdy iHkko iMrk gA fj;y Vkbe DokfVVfVo ikfyejkt pu fj;D'ku ¼RT-qCR½ ,d mPp iokg {kerk okyh] lonu'khy ,o iu:Riknu i)fr g ftll thu ,Dli'ku Lo:lk dk ,evkj,u, ¼mRNA½ VkUlfØIV l d lki{k foiyrk dk irk yxk;k tk ldrk gA ij bldh lR;rk ,l mi;Dr jQjUl thu ij fuHkj djrh g ft ldk ,Dli'ku Lrj fofHkUu ijh{k.k dh fLFkfr;k l xtju ij Hkh fLFkj jgA bl fn'kk e mPPk rkieku ij 7 fnuk ,o 60 fnuk rd ifUV;l lkQkj d xkukM dk j[kk x;k rFkk RT-qPCR fo'y"k.k e 10 lHkkfor jQjUl thu dh mi;Drrk dk eY;kdu fd;k x;kA bu 10 vyx&vyx thu dk ,Dli'ku fo'y"k.k RT-qPCR }kjk fd;k x;k rFkk budk eY;du pkj fofHkUu ,yxkfjFke] delta Ct, BestKeeper, geNorm ,o NormFinder }kjk fd;k x;kA bue l *eef1* vkj *b2mg* ifUV;l lkQkj eNfy;k d v.Mk'k; ,o oh;dk"k d fy; mi;Dr jQjUl thu ik; x; rFkk bUg bl eNyh d xkukM d thu ,Dli'ku fo'y"k.k e bVjuy dVky d :i e i;kx fd;k tk ldrk gA

,-egkfUr ,o fc-fi-ekgkfUr

fpfydk yxu d| tyh; rkieku dh igfr

vkfM'kk jkT; e fLFkr fpfydk yxu ,f'k;k dk lcl cMk [kkjk ty yxu g rFkk bldh ikfjfLFkfrdh dk n[kr g; bl pkj Hkkxk e ckVk x;k g& mRrjh] e/; {k=] nf{k.k {k= rFkk ckgjh puy {k=A ;g yxu tofofo/k l lk/kuk l Hkjij g rFkk bld eRL; mRiknu ij yk[kk eNvkjk dh vkthfodk fuHkj djrk gA bldh tofofo/krk dk v{k..k j[ku e to ikpyk fo'k"kdj ty d rkieku dk vf/kd egRo gA viy 2001 l ekp 2015 rd bld ty d rkieku d vkdMk dk ekfld ,o vkl r rkj ij fo'y"k.k fd;k x;k ftll yxu d iokg dh pØh; xfr vkfn dk v/;;u fd;k tk ldA bl vof/k e vkl r rkieku 21-66 l 33-93 fMxh l0 rFkk fofHkUurk x.kd ¼coefficient of variation½ 9-5 ifr'kr ik;k x;kA fo'y"k.k ;g crkr g fd ty d rkieku ,o iokg xfr o"k 2017&18 d leku gh jg ldrk gA

vkj-d-je.k] ,-d-lkg] fc-fi-ekgkfUr ,o fc-d nkl

mÙkj&ioh {k= ifj;kstuk d| vrxZr fd;s x;s dk;Z

vle d| ejh chy e| lp;u o)h l| eRL; mRiknu e| of)

lLFkku d {k=h; dUn] xokgkVh u ,,QMh lh fy0] xokgkVh d lg;kx l ekleh rkj ij [kyk ejh chy e eRL; lp;u fd;kA bl chy dk {k=Qy 20 g0 gA bl chy e NkVh vxfydvk dk pkj pkdkj iu {k=e lpf;r fd;k x;kA bu iu {k=k e dki eNfy;k dh Nh itkfr;k] *yfc;k jkfgrk] dryk dryk] fljfgul exyk] ,y xkfu;l] VukQfjxkMku bMyk rFkk gkbikFkyfefDFkl ekfyfVDl* dh 5 vxfydk ifr ox eh0 dh nj l j[kk x;kA ikp eghuk d ckn bu yxHkx 40]000 NkVh ¼LVVM½ vxfydkvk dk tuojh 2016 e eRL; LVkd lo/ku d fy; chy e Mkyk x;kA o"k 2016&17 d nkjku eRL; mit 1465 fd0xk0@g0@o"k iklr gvkA bl chy e vfrfjDr lp;u l fiNy o"k dh ryuk e oreku o"k d eRL; mit nj e 12-6 ifr'kr dh of) n[kh xbA

ch d HkVVkpk;] ,l ;xkie] ,d ;kno] iuo nkl] Mh ncukFk] ,u 'kekj ,l ckjkg] ,u ,l flg] d d ljek] ,o ,ddkrh

vle d| lekxjh chy e| lLFkku }kjk fodflr th vkbZ fitjk| dh Lfkiuk

fnukd 25 viy 2017 dk vle d lekxjh chy e lLFkku }kjk fodflr 16 th vkb fitjk dh LFkkiuk dh xbA ifr fitj dk vkdkj 5 x 5 x 2 eh0 FkkA oreku e bu fitjk e ekbuj dki itkfr] *yfc;k ckVk* dk ikyu fd;k tk jgk gA bu fitjk e vf/kd eY; ckt kj okyh eRL; itkfr;k d ikyu dh fn'kk e Hkh i;Ru fd;k tk jgk gA