Achievements of Results-Framework Document (RFD)

for

Central Institute of Fisheries Education

(2012 – 2013)

Address	Panch Marg, Off Yari Road, Versova, Andheri (West), Mumbai – 400 061 (Maharashtra)
Website ID	http://www.cife.edu.in

Section 1:

Vision, Mission, Objectives and Functions

Vision

To be a world class organisation providing leadership in fisheries education and research

Mission

To achieve academic and research excellence by creating state-of-the-art infrastructure and globally competitive faculty.

Objectives

a) To conduct academic programs for HRD and capacity building
b) To conduct basic and strategic research in emerging areas of fisheries science
c) To conduct Training Programs in fisheries

Functions

- To attend to matters relating to all aspects of higher education in fisheries science, research and training
- To participate in national and international collaborations
- To participate in national and international conferences, associations and other bodies dealing with fisheries research and education
- To identify researchable issues, planning strategies and action plans to realize the vision and mandate of the institute.

Consolidated Annual (April 1, 2012 to March31, 2013) Performance Evaluation Report of RFD 2012-13 of CIFE, Mumbai

Name of Institute Central Institute of Fisheries Education

RFD Nodal Officer Dr. Neelam Saharan

Objective	Weight	Actions	Success Indicator	Unit	Weight	Target / Criteria Value					Consolidated Achievements	Raw Score	Weighted Raw Score	Percent Achievement against Target values of 90 % Col.	Reason for shortfalls or excessive achievements if applicable
						Excellent	Very Good	Good	Fair	Poor					
						100%	90 %	80%	70%	60%					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
To conduct academic programs for HRD and capacity building in fisheries	34	HRD in specialized disciplines	No. of students passed	Number	30	80	75	70	65	60	84	100	30	112	The no of passed students depends on the Ph. D. students which varies every year
		Capacity Building	Training of staff for capacity building	Number	4	15	12	10	8	6	24	100	4	200	Some additional opportunity for training of staff came up.
To conduct basic and strategic research in	34	Urban aquaculture	Water budgeting for breeding	Number in lakhs	3	50	45	40	35	30	60	100	3	133	There was requirement for more spawn at Aarey farm

emerging areas of fisheries science			of IMC.												
		Non-food aquaculture	Breeding of stock of ornamental fish	Number (in lakhs)	3	2.0	1.8	1.6	1.4	1.2	1.80	90	2.7	150	There was more demand for ornamental fish
		Transgenic zebrafish for aquatic heavy metal pollution monitoring	Transgenic zebrafish broad spectrum biosensor responsive to heavy metals (Hg, Cd and Zn)	Date	3	1/2/2013	1/3/2013	15/3/2013	31/3/2013	_	1/2/13	100	3	100	-
		Vaccine development for nodavirus	Development of polymer based nano vaccine against nodavirus in *M. rosenbergii*	Number	3	2	1	0	0	0	2	100	2	100	-
		Bio diversity conservation and management	Taxonomy and Biodiversity of Aquatic Resources	Number	3.0	5	4	3	2	1	6	100	3	150	-

			Stock assessment employing statistical models and molecular tools	Number of stocks	3.0	3	2	1	-	-	3	100	3	150	-
		Management of aquatic resources	Assessment of PAH pollution in coastal Mumbai	Date	4.0	1/3/2013	8/3/2013	15/3/2013	31/3/2013	-	1/3/2013	100	4	100	-
		Physiological and nutritional interventions for enhancement of growth and reproductive performances in fish	To delineate physiological responses of stress in fish and its mitigation through application of nutraceuticals	Number of Nutraceuticals	3.0	3	2	1	0	0	3	100	3	150	-
			Developing feeding strategy for improving nutrient utilization and growth	Number of fish	3.0	2	1	0	0	0	2	100	3	200	-

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		Development of Value added products.	Development of Ready-to-eat Bombay duck strips and preparation of *Pangasius* mince based functional restructured product	Number	3.0	2	1	0	0	0	2	100	3	200	-
		Developing rapid method for identification of seafood pathogens, toxins and spoilage organisms	PCR characterisation of toxigenic *E coli* in seafood	Date	3.0	1/3/2013	8/3/2013	15/3/2013	31/3/2013	-	1/3/13	100	3	100	-
To conduct training programs in fisheries	20	Training and skill up-gradation	Number of persons trained	Number	20	500	450	400	350	300	777	100	20	172	Some State Govt. and NFDB sponsored training programs were also conducted on their request

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Efficient functioning of the RFD system	3	Timely submission of RFD for 2012-13	On time submission	Date	2	16th March,2012	26th March, 2012	27th March,2012	28th March, 2012	31st March, 2012	26th March, 2012	90	1.8	-	-
		Timely submission of results for 2012-13	On time submission	Date	1	1st May, 2013	2nd May, 2013	3rd May, 2013	4th May, 2013	5th May, 2013	-	0	0	-	-
Administrative Reforms proving internal efficiency / responsiveness / service delivery of Ministry/ Department	5	Implement ISO 9001	Prepare ISO 9001 action plan	Date	1	4th June, 2012	5th June, 2012	6th June, 2012	7th June, 2012	8th June, 2012	5th June, 2012	90	0.9	-	-
			Implementation of ISO 9001 action plan	Date	2	25th March, 2013	26th March, 2013_	27th March, 2013	28th March, 2013	29th March, 2013	14th March, 2013	100	2	-	-
		Implement mitigating strategies for reducing risk of corruption	% of implementation	%	2	100	95	90	85	80	100	100	2	-	-
	4	Implementation of Sevottam	Independent Audit of Implementation of Citizen's Charter.	%	2	100	95	90	85	80	100	100	2	-	-
			Independent Audit of implementation of public grievances redressal system	%	2	100	95	90	85	80	100	100	2	-	-

Total Composite Score = 98.4
Rating : Excellent

Details of Actions / Success Indicators

1. **Submission of Dissertation/theses** Following M. F. Sc. and Ph. D. Students submitted thesis from Jan., to April,, 2012 to March, 2013& their Viva Voce has been conducted.

Sr.No.	Name of the student	Regn. No.	Topic
Aquaculture			
1.	Mr. Aditya Kumar	AQ-247	Effect of probiotics on growth, survival, immune & biochemical response of *Litopenaeus vannamie* (Boone, 1931)
2.	Ms. Christina Lalramchhani	AQ-248	Biofloc as nutrient source and its effects on water quality and growth in common carp (*Cyprinus carpio,* Linnaeus, 1758)
3.	Ms. Babita	AQ-249	Studies on gonadal development in *Etroplus suratensis* (Bloch 1790) under different salinities
4.	Ms. Syed Talia Mushtaq	AQ-250	Evaluation of low cost, locally available protein sources as possible replacers of fish meal in the diet of rainbow trout, *Oncorhynchus mykiss* (Walbaum, 1972)
5.	Mr. Sambid Swain	AQ-251	Effect of vitamin E and vitamin C dietary supplementation on growth and survival of grey mullet *Mugil cephalus* (Linnaeus, 1758) Juveniles
6.	Ms. Gunjan Karnatak	AQ-252	Effect of Dietary prebiotic on growth survival and gut microbiota of *Tor khudree* fry
7.	Mr. Venkatesh Ramrao Thakur	AQ-253	Bionomics, breeding and reproductive biology of clown fish from Andaman waters
8.	Mr. R. Rajesh Kumar	AQ-254	Immunomodulatory effect of Bermuda grass (*Cynodon dactylon*) in the diet of *Labeo rohita* (Hamilton) fingerlings
9.	Mr. Lokesh Paul	AQ-255	Productional Potential and Economic Viability of Wastewater Aquaculture using Bio-wastewater from Dairy Industry
10.	Mr. Ramesh Tripathi	AQ-256	Studies on Hatching Performance of Indian Major Carps in Jar and Circular Hatchery
11.	Ms.Shilta M.T.	AQ-257	Comparative study of biofilm production in natural and artificial substrates and its effect on growth and immune response of *Etroplus suratensis* (Bloch, 1790)
12.	Mr. Yassine Mubarakali Gameredinn	AQ-258	Effect of different fertilizers on growth and survival of common carp, (*Cyprinus carpio*, *Linnaeus 1758*) fingerlings

Fisheries Resource Management			
13.	Ms. Divya Viswambharan	FRM-224	DNA Barcode of fish species from the ashtamudi lake in Kerala
14.	Mr.Renjith R.K.	FRM-225	Taxonomic study of selected species of family Nemipteridae along Indian Coast
15.	Ms.Jasmin F.	FRM-226	The study of the reliability of satellite data in forecasting protential fishing zone along Mumbai coast.
16.	Mr. Subal Kumar Roul	FRM-227	Stock identification of *Jhonie opssina* (Cuvier, 1830)
17.	Mr. Karankumar Kishorkumar Ramteke	FRM-228	Taxonomic study of Family Mullidae
18.	Ms. E.M. ChhandaPrajanadarsini	FRM-229	Stock identification of *Otolithes rubber* (Schneider, 1801)
Sr.No.	**Name of the student**	**Regn.No.**	**Topic**
19.	Ms. Wakambam Anand Meetei	FRM-230	Effect of salinity on the growth, yield and quality of agar content of Gracilaria spp.
20.	Ms. Bushra Shabnam	FRM-231	Studies on Impact of *Kappa phycusalvarezii* (Doty) Doty ex P.C. Silva, 1996, Cultivation on the survival and growth of Soft coral colonies
Post Harvest Technology			
21.	Ms. Sarika K.	PHT-66	Development of functional restructured product from *Pangasianodon hypophthalmus*
22.	Mr. Devananda Uchoi	PHT-68	Microbiological and Biochemical quality of salt fermented Indian mackerel, *Rastrelliger kanagurta* (Cuvier, 1816)
23.	Ms. Sreelakshmi K.R.	PHT-70	Development of Ready to Eat Sandwich Paste from Indian Mud crab
24.	Ms .Priya E.R.	PHT-71	Development of squid gelatin based edible bioactive film for fish preservation
25.	Mr. G. Janarthanan	PHT-72	Extraction and characterization of protein hydrolysates and lipids from shellfish waste
Fish Genetics & Breeding			
26.	Ms. Priyanka C. Nandanpawar	FGB-01	Development of nano delivery system of DNA in *Macrobrachium rosenbergii* and assessment of its possible toxicity
27.	Ms. Nimmy Jousy	FGB-02	Evaluation of culture systems for use in *Macrobrachium rosenbergii* (De Man, 1879) selective breeding programs

Fish Biotechnology			
28.	Ms.Suvra Roy	FBT-01	Identification and characterization of flanking regions of Δ^6 Fatty Acyl Desaturase partial gene sequence from *Pangasianodon hypophthalmus* by rapid amplification of cDNA ends (RACE)
29.	Mr. Mohan Ramesh Badhe	FBT-02	DNA barcoding of selected marine organisms
30.	Mr. Labrechai Mog Chowdhury	FBT-03	Studies on routes of delivery of pCMV-VP28-LH WSSV vaccine at different life stages of *P. monodon* with emphasis on field applicability
31.	Mr.Pradeep Kumar	FBT-04	Microinjection of biosensor constructs in zebrafish embryos and screening of mature zebrafish for transgenic individuals
Aquatic Animal Health Management			
32.	Ms. Tanuja Abdulla	AAH-01	Quantitative relationship and tissue tropism of *Macrobrachium rosenbergii* nodavirus (MrNV) and extra small virus (XSV) of *Macrobrachium rosenbergii*
33.	Mr. Bhartendu Vimal	AAH-02	Development of cell culture from *Pangasionodon hypophthalamus*
34.	Mr. Vikash Kumar	AAH-03	Evaluation of carageenan induced inflammation in *Labeo rohita*
35.	Mr. Chandra Bhushan Kumar	AAH-04	Development of nano-colloidal gold kit for rapid detection of *Edwardsiella tarda*
36.	Mr. S. Ayathulla Rabbani Syed	AAH-05	Development of *Edwardsiella tarda* Vaccine using outer membrane proteins (OMP) in *Labeo rohita*
Sr.No.	**Name of the student**	**Regn.No.**	**Topic**
37.	Mr. S. EzhilNilavan	AAH-06	Immunomodulatory and Antibacterial effect of Piperine in *Labeo rohita* (Ham.)
38.	Mr. Kusunur Ahamed Basha	AAH-07	Immunomodulatory and antibacterial effect of Andrographolide in *Labeo rohita* (Ham.)
39.	Mr.RajuBaitha	AAH-08	Development of enzyme-linked immunosorbent assay to quantify the immune response in mrigal carp (*Cirrhinus mrigala*) (Hamilton, 1922)

Fish Nutrition & Feed Technology			
40.	Ms.Shamna N.	FNFT-01	Impact of endosulfan and temperature on functional reproductive physiology of first generation Guppy (*Poecilia reticulate*) and its nutritional remediation
41.	Mr. K. Ramana Kumar Kotha	FNFT-02	Effect of qualitative and quantitative feed restriction on growth performance of *Labeo rohita* (Hamilton, 1822)
42.	Mr. Arunkumar R.	FNFT-03	Dietary evaluation of propolis for immunomodulation in *Labeo rohita* (Hamilton, 1822)
43.	Mr. Grace AngelC.	FNFT-04	Utilization of defatted *Jatrophacurcas* kernel meal in the diet of *Labeo rohita* (Hamilton, 1822) fingerlings
44.	Mr.Fawole Femi John	FNFT-05	Immunomodulatory response of dietary plant extracts in the diet of *Labeorohita*(Hamilton, 1822)
Fish Physiology & Biochemistry			
45.	Mr. Ankur Jamwal	FPB-01	Expression of hypoxia inducing factor (HIF) in response to hypoxia and temperature interaction in *Catla catla* (Hamilton, 1822)
46.	Mr. Rajesh M.	FPB-02	Regulation of HIF expression with respect to hypoxia and thermal stress interaction in *Cirrhinus mrigala* (Ham. 1822)
47.	Mr. S. Chandrasekar	FPB-03	Physiological responses of *Etroplus suratensis* (Bloch) to hypoxia stress under different salinity conditions
48.	Mr.Dilip Kumar Singh	FPB-04	Dietary effect of Zinc on muscle development and meat quality of *Pangasianodon hypophthalmus*
Fisheries Economics			
49.	Ms. Shiwangi Gupta	FEC-01	Impact analysis of snitary measures for export of fish and fishery product from West Bengal
50.	Mr. Sushil Subhash	FEC-02	Production and marketing of cultured shrimps in Thane district of Maharashtra
51.	Mr. Manish Rastogi	FEC-03	Marketing analysis of Indian Major Carps (IMC) and Catfish in Patna District of Bihar
52.	Mr. Apu Das	FEC-04	An Economic Evaluation of Aqua-Model village Scheme of Tripura
Aquatic Environment Management			
53.	Ms. Teena Jayakumar T.K.	AEM-14	Characterization of Mercury Resistant Bacteria in Thane Creek, Maharashtra
54.	Ms.SmrutirekhaSatapathy	AEM-15	Bioprospecting of selected algal species for silver nanoparticle production

Sr.No.	Name of the student	Regn.No.	Topic
55.	Mr. Arun Kumar O.R.	AEM-16	Characterization of Sewri-Mahul IBA: An important flamingo habitat along The Creek, Mumbai, India
56.	Mr. Shailendra Mohan Raut	AEM-17	Integrated Environmental Quality Assessment of Ulhas River Estuary, Mumbai
57.	Mr. Kapil Sukhadeo Sukhdhane	AEM-18	Polycyclic Aromatic Hydrocarbons (PAHs) contamination through oil spill in mangrove swamps of Mumbai
58.	Ms .Gnanam C.	AEM-19	Assessment of Polycyclic Aromatic Hydrocarbons (PAHs) in the Mangrove Ecosystem at Mahul Maharashtra
Fisheries Extension			
59.	Mr. Parag Saikia	FEX-16	An Assessment of Fisheries Extension Strategies and Delivery Systems in Assam
60.	Mr. N. Koteswari	FEX-17	Impact of Aqua-societies on Shrimp Farmers in Andhra Pradesh
61.	Mr. P. Sandeep Pedapoli	FEX-18	An study on the ICT based extension interventions in fisheries and aquaculture development in Andhra Pradesh
62.	Ms.BalaThongam	FEX-19	A study on the communication bejaviour of fishers, fish farmers and officers of fisheries department of Manipur
63.	Mr. Kaling Padung	FEX-20	A study on the communication behaviour of fishes, fish farmer and officers of Fisheries Department of Arunachal Pradesh
64.	Mr. Bhaskar Chakravarty	FEX-21	Potentialities of Public-Private-Community Partnership in Fisheries management for Rural Development in Kamrup District, Assam
65.	Mr. C. Lloyd Chrispin	FEX-22	A study on ICT based extension interventions in Fisheries and Aquaculture Development in Tamil Nadu
66.	Mr. Leo Cyril Antony Raja	FEX-23	Adoption of better Management Practices (BMPs) by Shrimp farmers in Karnataka
67.	Mr. Jackson Paul M.	FEX-24	Study on dissemination of Ocean information and advisory services to Fishers' in South Tamil Nadu

List of Ph.D. students awarded Ph.D. degree during 2012-2013

Sr. No.	Name of the student	Regn. No.	Batch	Topic of the thesis	Guide	Date of Viva-voce
1.	Ms.Vani. T.	IAC-235	2005-2008	Effect of Vitamin C and Selenium against Cypermethrin Toxicity in *Catla catla* (Hamilton, 1822) Fingerlings	Dr. Neelam Saharan	26.04.2012
2.	Mr. E. Suresh	FG-275	2006-2009	Genetic Diversity of Populations of *Macrobrachium rosenbergii* Using Microsatellites	Dr. A. K. Reddy	22.08.2012
3.	Md. ShahbazAkhtar	FNB-331	2008-2011	Physio-metabolic Responses of Tropical and Temperate Fish to Different Stressers and Their Mitigation Measure	Dr. A. K. Pal	03.09.2012
4.	Mr.SoibamKhogen Singh	AQ-318	2008-2011	Synergistic Effect of Dietary Preand Pro-biotics in *Labeo rohita* (Hamilton, 1822) Fingerlings Under Different Stressors	Dr. V. K. Tiwari	17.09.2012
5.	Mr.Lakshmisha, I.P.	PHT-244	2005-2008	Lipid Protein Interaction in Fish Meat during Accelerated Conditions and the Effect of Natural Antioxidants	Dr. T. V. Sankar	27.09.2012
6.	Ms.Asha Augustine	MC-241	2005-2008	Utilization of Starch and Cellulose by Microbial Symbionts in Selected Marine Fishes	Dr. Imelda Joseph	20.10.2012
7.	Mr.Tarkeshwar Kumar	FRM-310	2008-2011	Biology and Stock Assessment of *Johni eopssina* (Cuvier, 1830) from Ratnagiri.	Dr. S. K. Chakraborty	20.11.2012

8.	Mr. Anil Nilesh Pawar	AQ-312	2008-2011	Evaluation of Dietary Pre- and Pro-biotics for Improving Growth and Immuno competence of *Labeo fimbriatus*	Dr. M. P. Singh Kohli	24.01.2013
Sr. No.	**Name of the student**	**Regn. No.**	**Batch**	**Topic of the thesis**	**Guide**	**Date of Viva-voce**
9.	Mr.Pankaj Kishore	PHT-296	2007-2010	Ecology of *Yersinia enterocolitica* in Aquatic Foods	Dr. B. B. Nayak	28.01.2013
10.	Ms. A. Jeyakumari	PHT-324	2008-2011	Studies on Delivery of Omega-3 Fatty Acids Through Emulsification and Encapsulation	Dr. G. Venkateshwarlu	28.01.2013
11.	Ms. Deepa Sudheesan	FRM-256	2006-2009	Species Differentiation of Grey Mullets (Family : Mugilidae) from Indian Waters	Dr. A. K. Jaiswar	02.02.2013
12.	Ms.Biji Xavier	FNB-278	2006-2009	Effects of Mixed Feeding Schedule on Growth Performance and Metabolic Responses of *Labeo rohita* Fingerlings	Dr. K. K. Jain	11.02.2013
13.	Ms .Paramita B. Sawant	AQ-356	2009-2012	Habitat Status and Biodiversity of Powai Lake	Dr. Chandra Prakash	13.02.2013
14.	Mr.Tasaduq Hussain	FRM-342	2009-2012	Biology and Stock Assessment of Oil Sardine *Sardinellalongiceps*	Dr. S. K. Chakraborty	28.02.2013
15.	Mr. Annam Pavan Kumar	FB-272	2006-2009	Molecular Phytogeny and DNA Barcoding of Elasmobranchs from Indian Coast	Dr. W. S. Lakra	02.03.2013
16.	Ms.Shyne Anand P.S.	IAC-260	2006-2009	Effect of Dietary Supplementation of Periphyton Biomass and Biofloc on Growth and Immuno-physiological	Dr. MPS Kohli	21.03.2013

				Aspects		
17.	Mr. Hewawasam B. Jayasiri	AEM-379	2009-2012	Assessment of Persistent Organic Pollutants in Plastic Debris and Sediment	Dr. C. S. Purushothaman	25.03.2013

2. Training and skill up-gradation: Following training programs were conducted at CIFE Headquarters / Centres

Training Program	**No. of Training Program**	**Total Training Program**
Mumbai	4	61
Powerkheda Center	13	223
Kolkata Center	11	265
Kakinada Center	9	228
Total	37	777

3. Capacity Building:: 24 persons were trained in various capacity building programs. Their names are as follows:

S. No	Name of the staff member	Place of Training
1.	Dr. Neelam Saharan	NAARM, Hyderabad
2.	Dr. Geetanjali Deshmukhe	Institute of Remote Sensing and NIOT
3.	Dr, LathaShenoy	Institute of Remote Sensing and NIOT.
4.	Dr. Ashok Jaiswar	ZSI, Kolkatta
5	Dr. Paramita Sawant	CAFT, Mumbai
6.	Dr. Kiran Dube	BHU, Varanasi
7.	Dr. Chandra Prakash	CMFRI, Cochin
8.	Dr. G. Venkateswarlu	CFTRI, Mysore &NIAS, Bengaluru
9.	Dr. Sanath Kumar	World Bank platform at New Delhi.
10.	Dr. K. V. Rajendran	Indian Institute of Science, Bengaluru
11.	Dr R. P. Raman	Central Institute of Medicinal and Aromatic Plants, Lucknow
12.	Dr. K. Pani Prasad	Indian Veterinary Research Institute, Bengaluru
13.	Dr. A, Vennila	Central Agricultural Research Institute, Port Blair
14.	Dr. Kundan Kumar	College of Fisheries, Mangalore
15.	Dr. P. K. Pandey	National Bureau for Agriculturally Important Microorganisms, Mau
16	Dr. M. Makesh	National Institute of Immunology, Jawaharlal Nehru University, New Delhi
17.	Dr GayatriTripathi	Institute of Post-Graduate Medical Education and Research, Bose Institute, Indian Institute of Chemical Biology,Kolkata
18.	Dr S. P. Shukla	National Institute of Oceanography, Goa
19	Dr Megha Kadam Bedekar	Project Directorate on Animal Disease Monitoring and Surveillance, Bengaluru
20	Dr. Aparna Chaudhary	College of Veterinary Sciences & A.H., Anand, Gujarat.
21	Dr. S.N.Ojha	IIM, Ahmedabad
22	Dr. GirishBabu	IASRI, New Delhi
23	Dr. N.R.Kumar	NAARM, Hyderabad
24	Dr. Rama Sharma	Indian Statistical Institute, Mumbai

Water Budgeting for breeding of IMC

60 lakh spawn of Indian Major Carp s i. e. rohu, catla and mrigal were produced at Aarey Farm, Mumbai using Circular and FRP Jar hatchery.

Breeding of ornamental fish stock

1.8 lakh number of ornamental fish viz. discus, Oscar, gold fish, angels, fighters, tetras, zebra and livebearers were bred.

Developing feeding strategy for improving nutrient utilization and growth

As a strategy to optimize protein utilization in fish a mixed feeding trial was conducted in *Labeo rohita* fingerlings where continuously feeding of a diet having 30 % protein had similar ($p<0.05$) specific growth rate (SGR), weight gain % in compare to those group fed with 30% protein with alternative fasting for one days. Similar study was conducted in *Pangasianodon hypophthalmus* fingerlings where fish fed high protein (35%) and different levels of low protein (20% or 25% or 30%) at alternate days. Fish fed 35% protein diet followed by 25% protein diet at alternate day showed superior feed conversion ratio (FCR), Feed energy ration (FER), specific growth rate (SGR) in comparison to fish fed 35% diet continuously. This suggests a alternate day feeding appears to be economical rather traditional practice of continuous feeding with a fixed level of protein.

To delineate physiological responses of stress in fish and its mitigation through application of nutraceuticals

Three Nutraceuticals were tried to test their immunostimulating capacity when fish are exposed to stress. It was observed that fucoidan rich seaweed extract at 2-3% inclusion level in the diet of *Pangasianodon hypophthalmus* exhibited very little or negligible growth promoting response but increased the non-specific immunity in terms of higher TLC, phagocytic activity, NBT, lysozyme activity and higher survival after challenged with *Aeromonas hydrophila*. Similarly propolis extract at 1-3% inclusion level in the diet of *Pangasianodon hypophthalmus* exhibited very little or negligible growth promoting response but showed significant non-specific immunity. In hypoxia exposed fish, The temporal expression of alpha (HIF-1 α) gene in gill tissue was reported and the metabolic enzymes like hexokinase, LDH increased in liver and muscle, CA increased in heart and glycogen content depleted in liver whereas dietary vitamin E supplementation as nutraceutical has shown little role in modulating metabolic enzyme33s.

Assessment of PAH pollution in coastal Mumbai

Sediment and plastic pellet samples collected at various Mumbai beaches were analysed for seven polychlorinated biphenyls (PCBs), 16 organochlorine pesticides (OCPs) and 16 polycyclic aromatic hydrocarbons (PAHs) belong to three groups of POPs. The importance of plastics as a sorbent material to sorb hydrophobic contaminants has been demonstrated. The 16 PAHs of the priority list of the USEPA showed substantially higher mean ΣPAH

concentrations in the pellets at Mumbai beaches compared to the other studies. The concentration of fluorene was found to be the highest followed by those of anthracene, chrysene and phenanthrene. However, phenanthrene and anthracene were found as the most dominant PAHs with more than 95% of detection. The temporal variation was significant for ΣPAHs and ΣLPAHs while spatial variation was significant for ΣHPAHs. The significantly high concentration of ΣPAHs in July followed by September can be correlated with the two oil spills that occurred in July and August near Juhu beach. Significantly high ΣLPAHs in July and September confirmed the impact of oil spills on the accumulation of PAHs on pellets. However, significantly high levels of ΣHPAHs were observed in Versova due to its semi-enclosed nature with restricted water exchange. Further, Malad Creek which enters into coastal area of Versova might have brought land based PAHs. The PAH distribution index of ΣLPAHs and ΣHPAHs ratio revealed that the petrogenic sources were predominant in the area with significant temporal variation.

Preparation of Value added Products

Pangasius (*Pangasianodon hypophthalmus)* mince based restructured fish product (RFP) was prepared by both hot setting and cold setting methods. RFP was obtained by inclusion of sodium caseinate (1%) and egg white (2%) as additional protein substrates for microbial transglutaminase (0.5%). The quality of RFP was evaluated by analyzing their textural profile, colour attributes, oxidative stability and expressible water content. The synergistic effect of sodium caseinate and egg white with MTGase resulted in improved physico-chemical properties of products. Bombay duck strips were prepared from semi dried pressed and laminated Bombay duck. Seasoning, microwaving and further drying rendered them ready to eat. The final moisture ranged between 6-7%, had 6months storage in vacuum pack. The final yield was only 10% from the initial weight. The product scored 8.9 in the overall acceptance by the taste panel. The variation in the product was faced due to seasonal variation in the raw material which has been overcome.

Developing PCR based method for identification of pathogenic *E coli*

Two multiplex PCR protocols were tested for the detection of virulence genes of pathogenic *E. coli* in seafood isolates of *Escherichia coli*. In the first protocol, primers specific for *stx1*, *stx2*, *eaeA* and *hlyA* genes of enteropathogenic and enterohemorrhagic *E. coli* were used. In the second PCR, primers targeting enteropathogenic (*eae* and *bfpA*), enteroaggregative (*aggR*), enterotoxigenic (*elt* and *est*), enteroinvasive (*ipaH*) and Shiga toxin-producing *E. coli* (*stx*) were used. The first PCR protocol was found to be very consistent and yielded expected amplification products with no non-specific bands. This multiplex PCR yielded positive amplicons of *eae* gene with 10 *E. coli* isolates. The second PCR protocol was employed to simultaneously detect 5 pathogenic groups of *E. coli*. Though the *lt* (labile –toxin

gene of enterotoxigenic*E. coli*) could be detected in 4 isolates, the PCR protocol yielded non-specific bands with many other isolates. Efforts are in progress to improve this protocol by modifying the PCR conditions and changing the primer combinations. Optimization of this PCR protocol is necessary to detect multiple groups of pathogenic *E. coli* in a single PCR which could greatly reduce the time and effort required to detect diverse *E. coli* pathotypes in seafood.

To develop zebrafish biosensors for detecting heavy metal and genotoxic pollutants.

Wild type zebrafish embryos (1-2 celled) were microinjected and are being reared to maturity for breeding and screening of F_1 generation for transgenics. The F_1 offspring of MT1-dsRed transgenic zebrafish screened positive for the presence of transgene by PCR. However, two disease outbreaks occurred during the reporting period. In spite of several control measures most of the fishes died. A fresh stock of wild type zebrafish was procured recently and being maintained for developing transgenics. To replenish the transgenic stock the embryos are being microinjected with the biosensor transgene constructs. Embryos injected with the heavy metal constructs, MT1-dsRed, MT4-dsRed and zMT-dsRed were tested for reporter response in transient assays where 48 h old injected embryos were exposed to sub lethal doses of heavy metals (lead, copper, cadmium, zinc and mercury). All the constructs showed expression of the red fluorescent protein proving their functionality.

Development of polymer based vaccine against nodavirus in *M. rosenbergii*.

To develop a DNA vaccine against nodavirus in *M. rosenbergii*, the RNA interference mechanism is being used. For this, the partial viral gene is being cloned in pcDNA3.1 vector in both forward and reverse orientations simultaneously to express a hairpin RNA. The treatments showed 52% survival of the infected prawns against 100% mortality in positive control prawn. Two nano DNA vaccines viz. Chitosan-RDRPAS and Chitosan-XSVASAS were developed and tested against White Tail Disease of *Macrobrachium rosenbergii.* The treatments showed 52% survival of the infected prawns against 100% mortality in positive control prawn.

On time submission :

The RFD for 2012-13 has been submitted on time. Annual report is being submitted. ISO 9001 certificate has been procured..