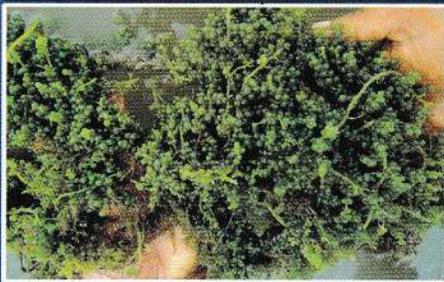


BANGLADESH  
FISHERIES RESEARCH  
INSTITUTE

AT A  
GLANCE



BANGLADESH FISHERIES RESEARCH INSTITUTE  
Ministry of Fisheries & Livestock  
[www.fri.gov.bd](http://www.fri.gov.bd)



# BFRI AT A GLANCE



**Bangladesh Fisheries Research Institute (BFRI)**  
**Ministry of Fisheries & Livestock**  
[www.fri.gov.bd](http://www.fri.gov.bd)



**BANGLADESH  
FISHERIES RESEARCH  
INSTITUTE  
AT A GLANCE**

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## Preface

Bangladesh Fisheries Research Institute (BFRI) was established in 1984 to conduct R&D in fisheries for its sustainable development. So far, research has made significant contribution in fisheries and aquaculture development in the country, which led to significant increase in fish production. Since inception of the Institute, it has been publishing and updating the brief profile of the institute containing relevant information and achievements. This is the sixth edition.

As it is well known, the present Government is committed to create new employment opportunities and meet nutritional food security for ever growing population of the country through development of its fisheries resources. In this regard, the sector has been given special importance in achieving the development goals as set out in SDG and the 7th Five Year Plan of the Government. In order to achieve the target, BFRI planned its research to help the Government achieving its stated goals and targets. Government has supported the development of the sector with the research led technologies and as a result of which Bangladesh now ranks 4th in the world in freshwater fish production and also is one of the top ten total fish producing nations consisting of culture and capture fisheries in the world.

Bangladesh has also achieved a remarkable success in hilsa fisheries development and management. BFRI has identified the breeding and nursery grounds of hilsa stretching from the Meghna estuary to riverine areas based on which the Government has established five sanctuaries where catching of hilsa of any size is banned for 22 days in peak breeding season. This has resulted in increase in production of hilsa to almost double in the last 15 years with a present production of about 0.39 million tons (2015-16). It has also developed artificial breeding and culture technologies of the indigenous endangered species like Mahseer, Gonia, Bata, Kalbaush, Bhagna, Pabda, Gulsha, Chital, Puti, Shorputi, Shing, Magur, Tengra etc. Significant success has also been achieved in development of improved strain of GIFT Tilapia, Rohu and Rajpunti. Development of breeding and culture technology of pangusius, (*Pangasianodon hypophthalmus*) opened a new era in the history of aquaculture in Bangladesh.

New jurisdiction established over a vast area in the Bay of Bengal after settlement of maritime dispute with Myanmar offer great opportunities for Bangladesh for further development of the marine fisheries through proper use and development of its blue economic resources on scientific basis. Oceans have large diversity of living resources. Mariculture of commercially important finfish, shellfish and plants, marine biotechnology, product diversification etc are highly important components of the blue economy in the fisheries sector. BFRI thus, in addition to finfish, has currently emphasized research on development of technologies for culture of non-traditional fisheries items like crabs, snails, mussels, seaweeds etc. in the marine sector.

**Dr. Yahia Mahmud**  
Director General

# BANGLADESH FISHERIES RESEARCH INSTITUTE

## ***Establishment of the Institute***

Fish and fisheries are integral part of the culture and heritage of Bangladesh. The sector plays an important role in nutrition, employment generation and foreign exchange earnings. Fish provides over 60% of animal protein intake of its population. Keeping in view of the immense potential of the sector in providing better nutrition and employment, particularly to the rural poor people, and the urgency for optimum scientific utilization of the country's rich aquatic resources for economic development, the President of the People's Republic of Bangladesh was pleased to promulgate an Ordinance entitled "The Fisheries Research Institute Ordinance, 1984" on 11 July 1984. In pursuance of this Ordinance, the Fisheries Research Institute (FRI) was established in July 1984. The institute was renamed in 1997 as Bangladesh Fisheries Research Institute (BFRI) following the Act passed by the parliament and assented by the President entitled "Bangladesh Fisheries Research Institute Act, 1997 (amended)."

Though the Institute was established in 1984, its full-scale operation began in 1986 after setting up its basic organizational structure, recruitment of manpower and creation of initial research facilities. Since then, the institute has been playing a key role in assisting the nation in achieving the goal of fisheries development as set out in successive national development plans through appropriate research.

It is a matter of great pride that the country could be able to make a mark globally in becoming the 4th largest aquaculture producer now through the research based aquaculture technologies. It is also one of the top countries in R&D in culture based capture fisheries, particularly in Oxbow lake fisheries.

## ***Vision***

The vision of the institute is to develop economically viable, environmentally sustainable, and socially acceptable fisheries and aquaculture technologies leading to optimize fisheries production in the country in conformity with the national policy relating to fisheries R&D.

## ***Mission***

Conduct need-based research to generate appropriate technologies for overall aquaculture and fisheries resources development of the country without impairing environment and social equity and assist the nation to meet the internal demand and export of fish and fishery products.

### **Mandate**

- To carry out basic and adaptive research for sustainable development and optimum utilization of all living aquatic resources;
- To coordinate and collaborate all fisheries research activities in Bangladesh nationally and internationally;
- To identify new production opportunities and evolve technologies to utilize them;
- To develop skilled human resources at all levels through higher research and training;
- To transfer of scientific technologies from Lab to users through demonstration and training of extension workers, fish farmers and other stakeholders; and
- To assist and advise the Government in all matters relating to research and management of living aquatic resources of the country

### **Management of the Institute**

The Institute is an autonomous research organization and is linked up administratively with the Ministry of Fisheries and Livestock (MoFL), Government of the People's Republic of Bangladesh. The general direction, administration, and supervision of the affairs of the institute are vested in the Board of Governors (BoG) consisting as follows:

#### **Board of Governors**

- Chairman : Hon'ble Minister, Ministry of Fisheries and Livestock
- Vice Chairman : Secretary, Ministry of Fisheries and Livestock
- Members : Member (Agriculture), Planning Commission
- : Executive Chairman, Bangladesh Agricultural Research Council
- : Vice-chancellor, Bangladesh Agricultural University, Mymensingh
- : Director General, Department of Fisheries
- : Two Members of the Parliament to be appointed by the Govt.
- : Two persons to be appointed by the Government from among the persons having interest in fisheries development
- : Two persons to be appointed by the Government engaged in research activities in the Institute
- Member-Secretary : Director General, Bangladesh Fisheries Research Institute

The Board of Governors may exercise all powers and doing all acts and things that may be performed or done by the institute. The Board may appoint such committees, as it may consider necessary to assist it in the performance of its functions. As the Chief Executive of the Institute, the Director General takes appropriate steps in implementing its programs in the light of the policies and directives formulated by the Board of Governors.

## **The Institute**

The Headquarters (HQ) of the institute is located in a beautiful campus in Mymensingh, which is about 120 km north of the capital city, Dhaka. The HQ is comprised of various administrative divisions, which are Administration & Finance, Research and Planning, Technical Training, Technology Testing & Communication, Engineering & Instrumentation, ICT, Library and Documentation and Public Relations. The institute accomplishes research through its five research stations and five sub-stations, which have been established in different strategic locations of the country based on the nature of the aquatic ecosystem (Fig. 1). The stations and sub-stations are to cater the emerging needs of Fisheries R&D based on multidisciplinary approach. The stations are headed by Chief Scientific Officers (CSO) and the sub-stations are headed by Senior Scientific Officers (SSO). The organogram of the institute along with the names of different stations and sub-stations is shown in Fig. 2.

### ***Functions of Headquarters***

The Director General is the Chief Executive of the institute and is responsible for overall management, supervision, and program implementation of the institute in accordance with the Government policy and decisions of the Board of Governors. In general, the Headquarters performs the following responsibilities:



### ***Research Planning and Management***

The research activities of the Institute are processed, managed, evaluated, and coordinated through its Research and Planning Division. Research and Planning Division initiates the research planning and evaluation process through a discussion meeting in the HQ. Each research station and substation identifies and reviews research topics based on local problems, which are discussed and shared with the scientists, Department of Fisheries (DOF) officials and other stakeholders at the regional level workshop. After regional level screening, the whole research plan is finally reviewed at a Central workshop participated by policy makers and other stakeholders. Research projects as finalized based on recommendations of the central workshop are subsequently reviewed by BFRI Research Committee. The research projects are then revised and prioritized based on decisions of BFRI Research Committee. The Annual Research Plan is finally evaluated and approved by a Technical Committee of senior scientists of the institute, representatives from the Ministry of Fisheries and Livestock, Planning Commission, Bangladesh Agricultural Research Council and Universities. The research plan as approved by the technical committee is reported to the Board of Governors for information and advice.

# BANGLADESH



Fig. 1. Location map of BFRl Station and Sub-Stations.

## ORGANOGRAM Bangladesh Fisheries Research Institute (BFRI)

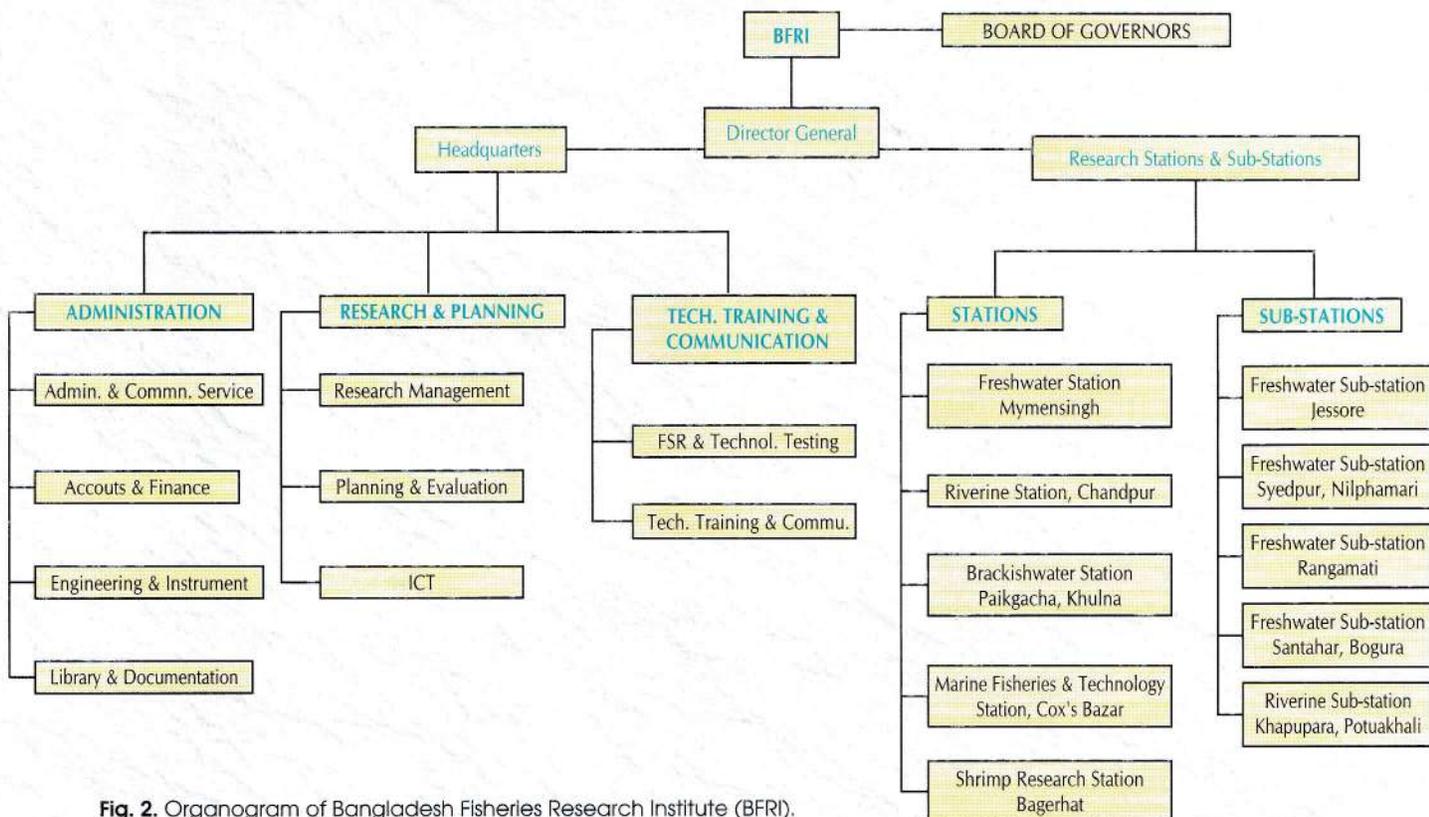


Fig. 2. Organogram of Bangladesh Fisheries Research Institute (BFRI).

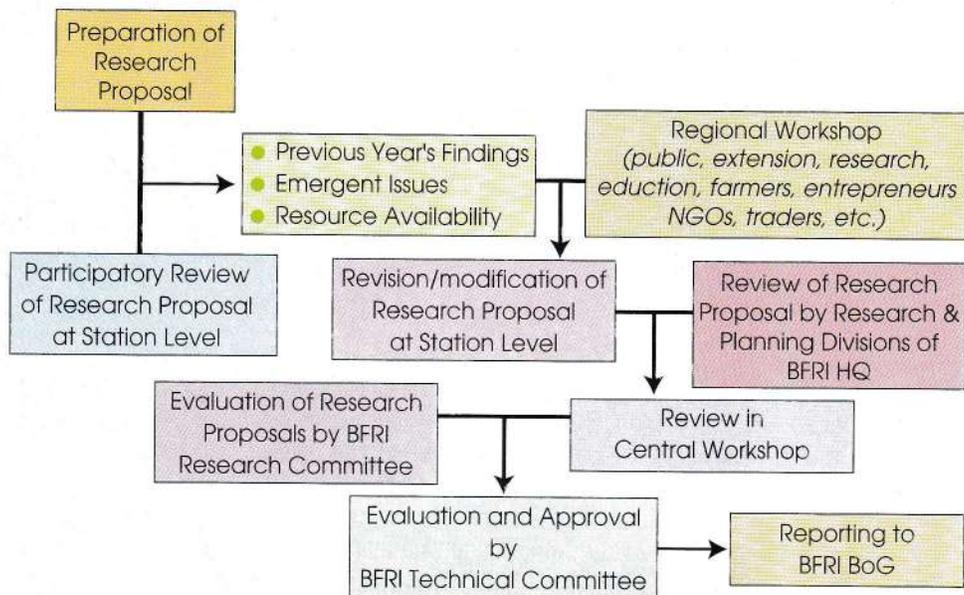


Fig. 3. Flow Chart of Research Planning Process.

### On-Farm Technology Trials

Research evolved technologies are fine-tuned through on-farm trials in different agro-ecological conditions before dissemination to the farmers. On-farm research of the institute is conducted directly to the farmer's ponds with the active participation of farmers. DoF officials of the concerned areas are also involved with on-farm trials.



### Farmer's Advisory Services

The Institute through its different Stations and Sub-Stations provides advisory services to the farmers on improved aquaculture practices, soil and water quality, feeding management, diagnosis and control of diseases etc.

### Manpower Development

The institute pays much attention in developing capacities of the scientists through in-country and overseas short and long-term study programs leading to MS & PhD including study tours and sabbaticals with the support from different national and international agencies. In the meantime, about 60 scientists have obtained PhD, and 15 have obtained MS degrees from overseas universities on fish feed and nutrition, fish genetic engineering, fish reproduction, freshwater and brackishwater aquaculture, mariculture, toxicology, fish disease, open water fisheries management and other alike subjects. Currently about 10 more scientists are pursuing PhD and MS degrees in-country and overseas. Some scientists have received short-term (7 days to 6 months) foreign trainings on different aspects of improved aquaculture and fisheries management. Many in-country short-term training programs on research planning and management, MIS, office management, ICT, e-GP, computer literacy etc. were also organized to improve the skills of the scientists and administrative personnel.

### Training and Workshop

Research activities of the institute tends to develop the fisheries sector by generating suitable and modern aquaculture technologies for better management of aquatic resources and increase fish production. The institute organizes series of well structured training programs every year to disseminate the research evolved technologies to the extension agencies and end users. The main objective of offering such type of need and opportunity based training is to transfer and disseminate technologies among various stakeholders and end users. During last five years a total of 375 training batches were completed and 7658 nos. of people were trained by the institute.



Hon'ble Minister for MoFL  
Inaugurating Workshop on BFRI  
Annual Research Plan (2016-2017)

Inaugural Session of National Workshop on  
Conservation of Halda River



The Institute also organizes national and international workshops and seminars in different disciplines to identify the problems and sharing and exchanging knowledge generated through research. The institute and its stations organizes regional and national workshops every year to review the research progress of the institute. Besides, the Institute recently organized some demand driven workshops on public health aspects of tilapia culture, diseases in climbing perch, conservation of River Halda as a natural breeding ground of carps etc.

### **Library and Documentation**

Bangladesh Fisheries Research Institute Library and Documentation Centre (FRILDOC) acts as a repository of literature and technical information and provides latest information on scientific research and experimental development in all branches of fish and fisheries. FRILDOC collections mostly include subjects on Freshwater Aquaculture, Brackishwater Aquaculture, Mariculture, Marine Science, Biology, Ecology, Environmental Science, Agriculture, Life Sciences, Seaweeds, Plankton, Food Processing, Feed and Nutrition, Zoology, Botany, Geography, Economics, Marketing, Geology, Socioeconomics and Rural Development.

The FRILDOC so far has 10,326 volumes of technical and general books, 175 titles of scientific periodicals and 5,078 scientific reprints in its collection. Besides, it has 500 theses, 76 Annual Reports, Aquatic Science and Fisheries Abstract (ASFA) DVD up to 2015 and The Essential Electronic Agricultural Library (TEEAL) up to 2013. In addition to FRILDOC, each outreach station of the institute has an individual library set up.

The FRILDOC is operating in a fully automated environment. The various activities of the centre have been computerized using Library Management Information System (LMIS) software. It provides documentation services i.e. Bibliographical Service, Abstracting Service, Document Delivery Service, Current Awareness Service, Selective Dissemination of Information (SDI), Digital Library Service etc.

The center also maintains exchange program with more than 60 leading national and international institutes/organizations.

### **Working Linkage**

The overall research, training, and management activities of the institute are carried out in close cooperation and linkages with various national and international organizations and agencies. The Institute also keeps close contact with public organizations (DoF, DAE, LGED, ARIs) and NGOs for dissemination of technologies and feedback to research. BFRI maintains close liaison and works in collaboration with various international organizations like World Bank (WB), USAID, IFAD, WorldFish Center, Winrock International, ACIAR/CSIRO, NACA, DFID, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) and overseas Universities for fisheries R&D. BFRI also conducts collaborative research with various Universities and exchange of expertise and share of knowledge.

### Implementation of Development Projects

BFRI collaborates with different national and international organizations in undertaking and implementing specific research and development projects aiming to develop the institute and evolve technologies through research.

Following seven development projects have been implemented by the institute during the last five years (2011-2016):

1. Infrastructural Development and Research Strengthening (IDRS) of Bangladesh Fisheries Research Institute.
2. Impact of Aquaculture Drugs and Chemicals on Aquatic Ecology and Productivity.
3. Fish Production, Conservation, Strengthening and Management of Kaptai Lake (BFRI-Part).
4. Jatka Conservation, Alternate Income Generation for Jatka Fishers and Research (BFRI-Part).
5. Impact Assessment of Upstream Water Withdrawal to Conserve Natural Breeding Habitat of Major Carps in the River Halda.
6. Integrated Agricultural Productivity Project (IAPP, BFRI Part)
7. Support to Sustainable Management of the Bay of Bengal Large Marine Ecosystem (BOBLME)

*The following three development projects are currently being implemented:*

1. Development and Dissemination of Pearl Culture Technology.
2. Culture of Cuchia (Mud eel) and Crab in the Selected Areas of Bangladesh and Research.
3. Strengthening of Hilsa Research at Riverine Station, Chandpur.

The implementation of the above development projects has significantly contributed to enhance research capacity of the institute, develop technologies and to increase fish production.

Earlier, the institute implemented a good number of research projects since its inception, which laid a good foundation of the institute along with infrastructural development. Following are some of the details of the projects:

1. "Assistance to Fisheries Research Institute (BGD/89/012)," an FAO/UNDP/GoB Project implemented successfully during 1992-94. The major output of the project was identification of the core research programme of BFRI, establishment of mechanism of research planning, monitoring and evaluation, strengthening of library and training of BFRI scientists in country and abroad.
2. "Hilsa Fisheries Development and Management Project" sponsored by IDRC, Canada and GoB during 1986-89. The project identified the natural breeding and nursery grounds of hilsa, quantified jatka catches (hilsa juveniles) and assessed negative impact of the use of current net (monofilament net) on hilsa population, the national fish of Bangladesh. The project developed hilsa fisheries management policy and guidelines for its management and conservation.
3. USAID/ICLARM/GoB assisted project on "Integrated Fisheries Research Project, Bangladesh" during 1993-95. Under the project, aquaculture component was incorporated for the first time into the Farming System Research of Bangladesh and implemented in collaboration with the Bangladesh Rice Research Institute (BRRI), Bangladesh Agricultural Research Institute (BARI) and Bangladesh Jute Research Institute (BJRI).

4. FAO/NACA TCP project on "Regional Study and Workshop on the Environmental Assessment and Management of Aquaculture Development (TCP/RAS/2253)" during 1992-94. The project made an assessment of the environmental impact on aquaculture by different factors and made positive contribution as per project objective.
5. "Fisheries Research Programme Development" during 1992-95. Two research Sub-stations were built, carried out renovation and supported core research projects of the Institute.
6. IDA/ODA supported "Third Fisheries Project, BFRI Component" during 1992-96. The productivity of the flood plain ecosystem and potential for artificial stocking was assessed for the first time in the country. Suitable packages of practices in terms suitable species, stocking size and stocking density and community management for culture based fisheries were developed. Harmful fishing gears used in flood plain fishing were identified and control measures suggested.
7. ADB/ICLARM assisted project on "Dissemination and Evaluation of Genetically Improved Farmed Tilapia in Asia" during 1995-97. The project played an important role in popularizing seed production and culture technologies of tilapia in Bangladesh. Since then tilapia has become an important aquaculture species in the country.
8. NACA coordinated project on "Regional Study of Fish Health Certification and Disease Reporting System" in 1996. Disease Reporting System was formalized and introduced in the country. Fish quarantine rule was then processed for formal adoption.
9. World Bank/GoB funded coordinated project on "Agricultural Research Management Project (BFRI-Component)" and Agricultural Research Project II during 1996-2002. This was a large investment project through which physical infrastructure of BFRI were developed, human resource developed through higher studies (PhD and Post-Doc), short term training, study tours overseas, in country technical training for scientists and farmers, modern equipment procured and laboratory facilities strengthened.
10. USAID/ICLARM assisted project on "Aquaculture Research for Sustainable Development" was implemented from 1996-2005. BFRI evolved small holder aquaculture technologies were widely field tested, standardized and disseminated in collaboration with NGOs in different agro-ecological regions in the country. NGO extension workers were trained on sustainable aquaculture technologies who in turn trained farmers, and the institute conducted required research on specific technological issues both on station and on farm.
11. ACIAR, Australia supported technical assistance project on "Hilsa Fisheries Research in Bangladesh" from 1995-2001. Hilsa Fisheries Management Policy was updated with detailed plan of action for regulation and conservation of the fishery.
12. IFAD/ICLARM supported project on "Rice/Fish Productivity Enhancement Research in the Flood-prone Ecosystem of Bangladesh" during 1997-2001. Production potential of fish in the deep water rice field ecosystem was assessed and popularized.
13. Research Project on "Genetic Improvement of Silver barb" during 2003-2005 was jointly implemented by BFRI, University of Stirling, UK and NAGRI, Thailand under DFID grant.
14. "Establishment of Shrimp Research Center at Bagerhat" during 2008-13 for research and training on development of shrimp resources in the coastal areas of Bangladesh. An impressive administrative-cum research building, training dormitory, shrimp hatchery and farm were constructed and modern equipment procured under the project.

## Research Strategies of the Institute under 7th Five Year Plan and SDG

In light of the goal of achieving nutritional food security and employment as stated in the Seventh Five Year Plan and SDG, BFRI is pursuing the following research strategies:

- Develop technologies for intensification and diversification of freshwater aquaculture for domestic consumption and livelihood development.
- Develop technologies for intensification of shrimp and other species for brackishwater aquaculture for export.
- Develop improved fish breeds through genetic research and prevent genetic deterioration/inbreeding in hatchery population.
- Assess quality and develop species-wise quality fish feeds and their marketing system.
- Develop sustainable management guidelines for open water capture fisheries in respect of over-exploitation, stock replenishment, and co-management of water bodies by involving local communities.
- Identification of new fishing zones and development of technologies for exploitation of deep sea resources.
- Environmental studies relating to water pollution, disease, climate change and other environmental degradation, and their effects on aquatic resources.
- Mariculture of commercially important shellfish, crab, seabass, seaweeds etc.
- Product development, quality control and marketing.



## Research Stations and Sub-stations of the Institute and their Activities

Presently the Institute has five research stations and five sub-stations under its purview. Research being carried out and significant contributions made by these stations and sub-stations are briefly described in the following sections:

### Freshwater Station, Mymensingh

The Freshwater Station is located in Mymensingh and is attached to the HQ of the Institute. It is the largest station of the Institute comprising an area of 40 ha. It has 118 drainable experimental ponds ranging in size from 0.02 to 0.62 ha and a well-designed modern carp hatchery (largest in the country) with a capacity of producing over 300 million fry annually. Other physical facilities include a number of modern research laboratories such as Fish Reproduction & Genetics, Fish Nutrition & Feeding, Soil, Water & Productivity Management, Fish Disease, Diagnostics & Health Management, and Pearl Culture Laboratory. Other infrastructures include a feed store, a newly established fish museum, newly established pearl culture building, 35-bed four-storied dormitory, and 5-bed guest house. There is 19 scientific and 51 supporting staff to perform research and management activities.



The station has three research sub-stations viz., 1. Flood Plain Sub-station, Santahar, 2. Freshwater Sub-station, Jessore, and 3. Freshwater Sub-station, Saidpur.



The station is actively involved in research on fish genetics, conservation of endangered fish species, establishment of live-gene bank, fish farming in seasonal ponds, carp polyculture, pearl culture, culture of freshwater mud eel, rice-fish farming, fish nutrition, fish disease and diagnostics, and socio-economic aspects of aquaculture. Meanwhile, the station has developed artificial breeding

and culture technologies of the indigenous endangered species like Mahseer, Gonia, Bata, Kalbaush, Bhagna, Pabda, Gulsha, Foli, Puti, Shorputi, Shing, Magur etc. These species are now being commercially cultured and their availability has significantly increased in the market. The station has also achieved significant successes in development of improved strain of GIFT tilapia and rohu fish, monosex seed production of tilapia, development of low-cost quality feed, small-scale pellet machine development, and integrated aquaculture-agriculture farming. The significant research achievement of the station are as follows:

### Significant Research Achievement

- Development of improved rohu fish (*Labeo rohita*) stock through cross breeding among the broods collected from natural stock of different river systems. This cross-bred rohu is 17% higher growth performing than existing stock.
- Development and production of BFRI super GIFT tilapia, which is 49% higher, and BFRI Rajpunti which is 30% higher than that of the existing stocks of the respective fish population.
- Development of induced breeding and seed production techniques of six endangered species of carps viz., *Labeo bata*, *Puntius sarana*, *Chirihinus reba*, *L. calbasu*, *L. gonia* and *Tor putitora* and five species of catfish viz., *Mystus seengala*, *Ompok pabda*, *Mystus cavasius*, *Heteropneustes fossilis* and *Clarius batrachus*.
- New pure stocks of Thai pangasius (*Pangasius hypophthalmus*) and Thai koi (*Anabas testudineus*) have been imported from Thailand and are being reared under stock development program. Research for development of pure line of these species has been in progress.
- Production technology of 3-5 mm size pearl in indigenous freshwater mussel has been developed. Success has also been achieved in producing different types of image pearl.
- Culture and seed production techniques of cuchia (mud eel) has been successfully developed under controlled conditions.
- Production system of safe fish and vegetables has been developed using aquaponic technique.
- Causative agents (Noda virus and Rhabdo virus) responsible for recent mass mortality of Shing (*Heteropneustes fossilis*) in Mymensingh area have been identified. Research is being continued for production of vaccine for prevention of this disease.
- Causes of disease outbreak in Vietnamese koi and tilapia have been identified as due to invasion of pathogenic bacteria, *Streptococcus agalactiae*.
- Carp fish breeding and their hatchery and nursery management.
- Collection and preservation of pituitary gland for artificial breeding.
- Polyculture of carps.
- Development of quality fish feed from indigenous ingredients and methods of application.
- Development of system for fish health management, disease diagnostics and its remedial measures.
- Polyculture of tilapia with koi and shing.
- Fish culture in rice fields.



### Recent Success in Seed Production and Culture of Freshwater Eel

*Monopterusuchia* commonly known as mud eel, swamp eel or cuchia is an obligate air-breathing freshwater fish species. In Bangladesh, the species is available in mud holes, shallow beels and paddy fields. Its natural foods are fish, snails, aquatic insects, invertebrates, worms, etc. In Bangladesh, only the tribal people consume this fish. However, cuchia is commercially important because of its high export market. There are four species of eel, viz. *Monopterusuchia*, *Anguilla bengalensis*, *Pisodonophis boro* and *Pisodonophis cancrivorus* are available in Bangladesh, of which, *M. cuchia* is presently exported to Japan, Korea, Hong Kong, Thailand, China and Taiwan. As culture of cuchia is not yet developed, all cuchia as exported from Bangladesh are collected from natural waters.

In the meantime, Freshwater Station along with its Flood Plain Sub-Station, Santahar has initiated research for development of seed production and culture technology of mud eel (*M. cuchia*). Biology, food and feeding habit and reproductive behavior of eel have been determined under the research. Primary success has also been achieved in small-scale seed production and culture of cuchia in ponds.



### Success in Freshwater Pearl Culture

Pearl is one of the most attractive objects of adoration and called the queen of the jewels. In Bangladesh, imported pearl is mainly used. Therefore, BFRI initiated a comprehensive research work on pearl production in the country. Meanwhile, Freshwater station has succeeded to produce both rice and image pearl in native mussel (*Lamellidens marginalis*). Maximum 12 pearls were produced in a mussel. The average sizes of pearls were 3-5 mm and their colors were pink, white, ash and orange. Recently, the scientists succeeded to produce round and regular shaped pearl through nuclei operation. However, the size of pearl in our native mussel is tiny, which is called 'rice pearl'. To make it economically viable bigger size pearl is needed. Therefore, fine tuning of technology is in progress. The Institute recently imported larger size of pearl producing mussel, *Hyriopsis cumingii* from abroad in order to produce bigger size of pearl. Research along this line is underway.



### **Floodplain Sub-Station, Santahar, Bogra**

The Floodplain Sub-station was established in an area of 4.04 ha at Santahar of Adomdighi Upazilla under Bogra district in 1991. The Sub-station consists of 10 grow-out/rearing ponds (average size, 0.14 ha), 6 nursery ponds (average size, 0.04 ha), one carp hatchery and two deep tube-wells. This sub-station is entrusted to conduct limnological and ecological research on assessment and monitoring of productivity, biodiversity, gear selectivity, aquatic pollution and other environmental impact on floodplain fisheries, restoration and rehabilitation of depleted fisheries for development of management guidelines for enhancement of productivity in floodplain fisheries of the country. The sub-station has identified the problems of floodplains for reduction of breeding opportunities, depletion of brood fish, harmful impact of using destructive fishing gears on fishstock, impact of rapid drying of waterbodies, negative impact of stocking common carps on zeol fish (shing, magur and koi), outbreak of EUS (epizootic ulcerative syndrome) etc and developed management guidelines for implementation to increase production from floodplains. The sub-station has successfully developed breeding and seed production techniques of meni fish, *Nandus nandus*. Recently, research has been taken up for early breeding of Thai pangas using green house concept, and preliminary success has been achieved.



### **Significant Research Achievement**

- Development of management guidelines for artificial stocking of floodplains to enhance production.
- Gear selectivity study of floodplain fishery in Bangladesh.
- Assessment of primary productivity and identification of suitable species for artificial stocking.
- Identification of causative agents and impacts of environmental factors on the outbreak of EUS in floodplain areas and measures to control.
- Development of breeding and seed production techniques of meni fish, *Nandus nandus*.

### **Freshwater Sub-Station, Jessore**

Freshwater Sub-station, Jessore was established and launched its research activities in 2004 aiming to develop technologies for sustainable aquaculture development in the region. The sub-station is comprised of an area of 4 ha with 16 ponds ranging from 0.02-0.23 ha, one two storied office-cum laboratory building and two residential buildings. It is also facilitated with a carp hatchery for conducting research on fish breeding, genetics and reproduction.

Jessore is known to be a pioneering area for carp seed production in the country. However, carp culture was greatly suffered due to massive deterioration of stock both in hatcheries and in nurseries by inbreeding depression, which prevailed for a decade. Therefore, the sub-station gave a major thrust on research in brood development of major carps



and has been successful in developing genetic techniques for improvement of broodstock. In the meantime, demonstration of techniques of broodstock improvement and management, and hands-on training to the hatchery and nursery operators has largely solved the inbreeding problem. Now the hatchery operators know well about the inbreeding problem how it occurs in hatchery-bred populations and are now able to manage the problem by proper application of genetic principles in the development, management, and maintenance of brood bank for carps and other species. The sub-station has also conducted significant studies on the prevention and control of larneasis and argulosis disease in fish in Jessore region.

#### **Significant Research Achievement**

- Development and establishment of improved carp brood stock.
- Adaptation of BFRI evolved technologies in Jessore area.
- Diagnosis and control of diseases in hatchery populations.
- Effects of climatic conditions on fisheries in Jessore area.

Besides, the sub-station provided improved broods, technical advisory services and hands-on training to the hatchery and nursery operators, which resulted in sufficient reduction of inbreeding depression in hatchery population.

#### **Freshwater Sub-Station, Saidpur**

The Sub-station was established in Saidpur Upazila of Nilphamari district in the north Bengal in 2006. It has an area of 4 ha with 27 drainable nursery and rearing ponds ranging from 60 to 250 m<sup>2</sup> in size. There is a carp hatchery in the sub-station.

The northern area of the country is primarily draught-prone and most of the ponds are small and seasonal. Therefore, the people in the area have a general perception that those small and seasonal ponds are not suitable for fish culture. In this context, the thrust area of research of this Sub-station is to develop appropriate technologies for production of fish seed of desired species, development of suitable fish culture techniques for seasonal ponds, and socio-economic aspects of freshwater aquaculture in the area. In the meantime, the findings of the participatory research of the Sub-station and successful demonstration of small fish culture technologies like tilapia, koi, shing, magur and rajpunti in seasonal ponds has changed the negative idea of the pond owners of the area and encouraged them to undertake culture of the above species in their seasonal ponds. Now they can easily produce 4-5 tons of fish per hectare in six to eight months.

### **Breeding Success on Tengra, *Mystus vittatus***

Striped dwarf catfish, *Mystus vittatus*, locally known as 'Tengra', is a freshwater Small Indigenous Species (SIS) available in inland waters viz, rivers, canals, beels, floodplain, ponds and swamps of Bangladesh. IUCN (2016) reported it as an endangered species. In this context, Freshwater Sub-station, Saidpur carried out research on its induced breeding, nursery rearing and culture in captive condition. The sub-station achieved success in induced breeding and nursery rearing of this species in 2016. Study on culture potentials of this fish in pond has been in progress.



### **Significant Research Achievement**

The sub-station also provided technical services to establish hatchery for breeding of koi, shing and magur and conducted hands-on training to the hatchery and nursery operators and farmers for dissemination of suitable aquaculture technologies in the region.

### **Riverine Station, Chandpur**

The station is situated in the riverine district of Chandpur comprising an area of 13.02 ha. It has 25 earthen ponds ranging from 0.12 to 0.37 ha. In addition, the station has two office-cum-laboratory buildings comprising five specialized laboratories and a library, two hatcheries, residential quarters, and a guest house. Recently, a well equipped research vessel "R.V. Rupali Ilish" has been procured for undertaking riverine surveys and studies relating to hilsa fisheries research. The research laboratories of the station are Stock Assessment and Resource Dynamics, Resource Management and Conservation, Reproductive Biology of Riverine Species, Fish Health Management, and Environment and Aquatic Pollution. The station has started research in 1986 with the mandate to develop management guidelines for conservation and management of inland open water fisheries of the country. At present, the station has 14 scientific and 33 supporting staff to conduct research and provide technical services to the farmers and fishers. There are two research sub-stations under this station viz., (1) Riverine Sub-station, Rangamati, and (2) Riverine Sub-station, Khepupara, Potuakhali.



### Remarkable Success in Hilsa Research

The most remarkable success of the station is the development of an effective management guideline for conservation and development of the national fish of the country, the Hilsa (*Tenualosa ilisha*). Hilsa is the largest single fishery in Bangladesh with current annual production of about 0.39 million tons which contributes about 11% of total fish production of the country. It is important to note that the development and implementation of hilsa management guidelines have contributed to progressive increase hilsa production in recent years. About 2% i.e., 2.5 million of total population of the country are directly involved with hilsa fishery for their livelihood.

Since inception, the station has conducted extensive research on various aspects of hilsa biology, life cycle and its ecosystem. The research generated extensive information on limnology, ecology, population dynamics, migration and distribution of grow out hilsa and juveniles, maturity and fecundity; state of matured and running male and female hilsa (state of oozing eggs and coming out milt) post spawning hilsa, survey of spawning grounds, spawning season, use of current jal (monofilament net), statistics of jatka (juveniles of hilsa) caching etc as required for formulation of policy and action plan for conservation of jatka and mother fish. For the first time the quantity of jatka caught by monofilament net locally called 'current jal' in one month from 15 February to 15 March was estimated to be about 3,500 tons and a forecast was made about its devastating effect on overall hilsa production. Above research findings led to formulation of hilsa management and action plan, which is regarded as a milestone in hilsa fisheries research in Bangladesh. Based on the formulation of research evolved management and action plan, the Government imposed ban on catching of hilsa of all sizes for 22 days during peak breeding season from 12 October to 2 November according lunar calendar (4 days before and 17 days after full moon and the full moon day). Catching of Jatka was prohibited for 8 months from November to June,



which made opportunity for Jatka to grow bigger. The largest spawning ground of hilsa was identified in Dolchar, Moulvir Char, Kalir char and Monpura up to Chandpur of the Meghna River basin. To ensure livelihood and social security of the hilsa fishers during banning period, the government has introduced food and cash aid programs through their registration. Due to implementation of these activities of the government, production of hilsa has increased to almost double in the last 15 years.

Another important achievement of the station is the development of breeding and culture technique of Thai pangasius, *Pangasianodon hypophthalmus*. Demonstration of breeding technique to the hatchery operators has tremendous impact on expansion of breeding and culture technologies of pangasius in the country. Other important contributions of this station are determination of toxic effects of pesticides on fish, management of beel and haor fishery, breeding of important riverine fishes, identification of natural breeding grounds and breeding seasons of carps in major river system of Bangladesh, culture of fish in pen and cages, prawn seed production in backyard hatchery, and impact of traditional fishing crafts and gears on natural fish stock.

### Significant Research Achievement

- Identification of five major spawning grounds of hilsa in Dolchar, Monpura, Moulvirchar, Kalirchar in the lower Meghna River. These extensive areas of the Meghna do not have any salinity from July to October.
- Identification of five nursery grounds of hilsa in the lower Meghna, Shahbazpur channel, Tetulia river, lower Padma river and Andharmanik river. Sanctuary has been established in these areas and ban on hilsa fishing during nursing period has been imposed for protection of Jatka. The stretches of the Meghna River from Satnol to Chandpur and from Chandpur to Hajimara, Nilkamol also are a large and excellent nursery grounds.
- Identification of natural breeding grounds and breeding seasons of carps in major river system of Bangladesh.
- Development of technique for production of post-larvae of giant freshwater prawn, *Macrobrachium rosenbergii* in backyard hatchery.
- Impact of different adaptive fishing gears on the fisheries of the river Meghna has been studied and the harmful gears identified. Among them, the pangus chai was found to be the most detrimental, which kills more than 100 kg pangasius fry per haul of 8-10h.
- Development of pen and cage culture of tilapia and carps.
- Preliminary success in breeding and seed production of local pangus, *Pagasius pangasius*.

### Riverine Sub-Station, Rangamati

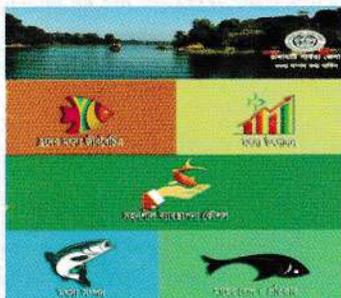
This Sub-station is situated in Rangamati Hill Tract district town in an area of 0.19 ha office campus and 0.31 ha separate residential campus. Recently, a three-storied building comprising of two laboratories viz., Water and Soil Quality and Fish Biodiversity has been established to strengthen research capacities of the sub-station. The Sub-station started in 1986 with the objective of formulating a sustainable management strategy



for the development of Kaptai Lake fishery. The priority research of the sub-station has been to carry out progressive monitoring of biological productivity, stock assessment and population dynamics of various commercially important fishes of the lake, particularly the major carps. Since 2012, the sub-station has been conducting research on cage culture of tilapia and creek culture of major carps to increase production of the lake and to provide livelihood to fishers during the period of fishing ban in the lake. The local people and the lake fishers have already adopted these culture practices in different parts of the lake.

### Significant Research Achievement

- Assessment of biological productivity of Kaptai lake.
- Optimization of artificial stocking in the lake and compliance to annual fishing closure for sustainable production from the lake.
- Assessment of biodiversity of Kaptai lake.
- Culture of major carps in creeks.
- Development of cage culture of tilapia in Kaptai lake.
- Development of Digital Apps on sustainable management of Kaptai lake.



### Riverine Sub-Station, Khepupara, Potuakhali

Khepupara Sub-station was taken over by the Institute from Bangladesh Fisheries Development Corporation (BFDC) in 2000. The sub-station is situated on the bank of Andharmanik River at Khepupara (Kolapara) under Potuakhali district in an area of 3.20 ha. The station has 10 experimental ponds. The objective of the sub-station is to conduct research on climate change adaptation, hilsa and other capture fisheries development and management. A research on breeding and culture potential of Kain magur (*Plotosus canius*) has been initiated from the sub-station.



### Brackishwater Station, Paikgacha, Khulna

The Brackishwater Station (BS) has an area of about 32 ha and located at Paikgacha Upazilla under Khulna district. The station has 53 drainable experimental ponds of different sizes from 0.05-1.0 ha and a hatchery for the production of shrimp, prawn, crab and other commercially important brackishwater fin fish seed. There is an office-cum laboratory building, where a number of well-equipped laboratories on Soil, Water Quality and Productivity Management, Brackishwater Aquaculture, Estuarine Ecology and Environment, Nutrition and Feeding, Disease Diagnostics and Control, Reproductive Physiology and Environment, and Live Feed Culture were established. Besides, the station has a guest house, a dormitory, and a full residential facility for the

officers and staff of the station. At present, the station has 10 scientific and 29 supporting staff to conduct research and management of support services. The station conducted an important survey on the impact of wild shrimp seed collection on aquatic biodiversity, the findings of which led the government to impose ban on collection of shrimp post-larvae from natural sources for protection and maintenance of coastal biodiversity. Besides, significant studies have been conducted on development of different shrimp culture systems, crab fattening, hydrobiology of river ecosystem, integrated paddy cum fish/shrimp culture, environment friendly shrimp and finfish rotational farming in coastal ghers (*enclosures*), post-harvest handling of shrimp, breeding of parse (*Chelon subviridis*) and catfish nona-tengra (*Mystus gulio*), shrimp disease diagnostics and control, and socioeconomics of shrimp culture in the coastal region.

### **Significant Research Achievement**

- Survey of shrimp seed resources in the coastal areas of Bangladesh and the impact of wild seed collection on coastal biodiversity.
- Socio-economic impact and constraints of shrimp culture in Bangladesh.
- Development of technology for semi-intensive culture of shrimp in closed system to prevent the risk of outbreak of virus disease. Farmers have already adopted this technology.
- Development of short-duration (65-70 days) improved extensive shrimp culture system. By using this technology, the marginal and mid-level farmers can easily produce 1000-1200 kg/ha of shrimp without any supplementary oxygen.
- Improved culture of penaeid shrimp in gher/enclosure.
- Development of techniques of mud crab fattening in pens and cages made of bamboo slits. Recently, preliminary success has been achieved on production of crablet (*Scylla olivacea*) in the hatchery.
- Development of breeding and seed production technology of brackishwater catfish, *Mystus gulio* and green back mullet, *Chelon subviridis*.
- Techniques for early maturation of freshwater prawn, *Macrobrachium rosenbergii* in winter has been developed using green house concept, which helped to extend culture period and increase production.
- Development of techniques for live feed culture. Population of three phytoplanktons and one zooplankton (rotifer) are being maintained in the laboratory culture system. This is facilitating seed production of commercially important brackishwater fish and shellfish.

### **Recent Success in Breeding of *Chelon subviridis***

Green back mullet, *Chelon subviridis*, earlier known as *Liza subviridis* is a brackishwater mugilid fish. The fish is locally known as parse/bata and available in shallow coastal waters, estuaries, and mangrove swamps of Bangladesh. Due to high quality of flesh, high economic value and for wide temperature and salinity tolerance, this species is getting popular for aquaculture in the intertidal areas. This is a winter breeder fish and



its hatchlings depend completely on live feed for their development in the early stages. Due to indiscriminate harvest from natural sources and for some environmental reasons, its natural abundance is decreasing day by day. Considering this, the scientists of Brackishwater Station of BFRI have achieved success to breed this fish in controlled condition through hypophysation. The development will pave the way of conservation of its natural stock and increasing its production through aquaculture in the coastal *ghers*.

#### **Preliminary Success in Crablet Production of Mud Crab**

The Brackishwater Station has initiated the breeding of mud crab (*Scylla olivacea*) in 2016. Preliminary success on crablet production has been achieved. Besides,

for crablet production, berried crabs were developed in the hatchery through eyestalk ablation of gravid crab. After hatching, the larvae pass through five zoea stages and then metamorphosed to megalopa larvae, which ultimately converted to crablet. The larvae feed on microscopic live feed, rotifer, which depends on unicellular algae for food. However, breeding technology of mud crab needs more refinement which is in



now progress. Standardization of this technology will unveil a new horizon for conservation of natural mud crab stock and increasing its production.

#### **Marine Fisheries and Technology Station, Cox's Bazar**

The Marine Fisheries and Technology Station is located on the sea shore at Cox's Bazar. Built in an area of 4 ha, the station has 39 outdoor concrete cistern complex (200 m<sup>2</sup> each), residential buildings, a service building and a guest house. It has four specialized laboratories namely, Marine Biology, Live Feed, Disease Diagnostics and Control and Fish Processing and Product Development. Presently, the station has 9 scientific and 14 supporting staff to conduct research and provide support services. Since inception of the station in 1991, it has been conducting research on stock assessment and population dynamics of commercially important marine species,

coastal ecology, breeding and culture of fish, shrimp and crabs, shrimp disease diagnostics and control and product development, which led to development of some production technologies of shrimp, mullet, seabass, mud crab, and management guidelines for development marine fisheries.

New jurisdiction established over a vast area in the Bay of Bengal after settlement of maritime dispute with Myanmar and India unlocked a new horizon for Bangladesh for development of blue economy for prosperity today and long in future through appropriate use of the sea and its resources. R&D in the marine sector did not receive much attention in the national program in the past due to lack of expertise and adequate funding. Oceans are critical to sustain life on earth and billions of people around the world are dependent on oceans for livelihood, economic development, and food security. Therefore, health and environment of the marine ecosystem play an important role in sustainable production and deriving optimum economic benefit from the seas. Survey of fishing grounds, assessment and exploitation of deep-sea resources, post-harvest handling and product development are the common areas of research in the marine sector. However, oceans have large diversity of living resources.

Mariculture of commercially important finfish, shellfish and seaweeds, marine biotechnology, product diversification etc. are the highly important sector of blue economy. They have great potential for development as a source of food and for other non-food uses under the blue economy program. BFRI thus, in addition to finfish, is currently emphasizing research on development of technologies for culture of non-traditional items of shellfish and plants



like crabs, oysters, sea cucumbers, seaweeds etc. in the marine sector. However, development efforts in blue economy in the context of fisheries must have matching advanced knowledge in various disciplines of marine fisheries to develop and reap optimum benefits from fisheries component of the blue economy, which is also being developed.

#### **Significant Research Achievement**

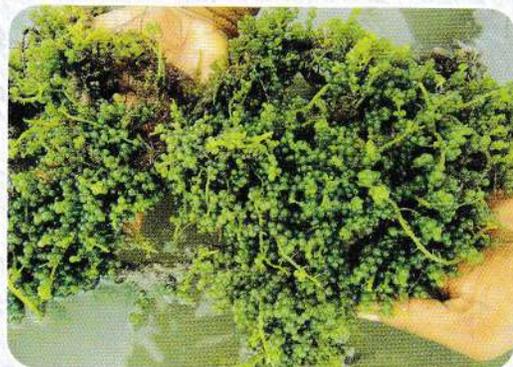
- Development of symbiotic mixed culture of sea bass and tilapia.
- Environment friendly rotation-based shrimp and fish culture in the coastal areas to minimize the outbreak of virus disease in shrimp.
- Development of technology for production of improved quality dried fish using solar dryer and mechanical dryer. The technology is being widely used by the dry fish producers in the Cox's Bazar area.
- Preliminary success on seed production of mud crab, *Scylla* spp.

- Identification of 63 species of seaweeds available in Cox's Bazar coast of which, 10 species were found commercially important. *Hypnea* sp. has been successfully cultured in net made of coir rope in Saint Martin Island and in Cox's Bazar coast. Study revealed possibility of large-scale commercial culture of seaweeds along the Bangladesh coast.
- Data collected so far indicates that catch per unit effort (CPUE) of different fishing gears in the Bay of Bengal has been declining year after year indicating that the stocks of different important commercial fisheries have been on decline, which needs special measures for proper management and development.
- Inventory of shark species in Bangladesh coast has been made and a management strategy of shark has been developed in collaboration with BOBLME (FAO) project.
- Development of live feed culture techniques of some microplanktons such as *Skeletonema costatum*, *Thalassiosira* sp., *Chaetoceros gracilis*, *Tetraselmis* sp., *Nannochloropsis oculata* and rotifer, *Brachionus rotundiformes* which will facilitate seed production of different commercial species of marine fish and shell fish.



### Success in Seaweed Culture

Seaweeds are traditionally consumed in the orient as part of the daily diet. Human consumption of seaweeds are high in Asia, mainly in Japan, China and Korea. Seaweeds has plenty of essential nutrients, especially trace elements and several other



bioactive substances. In Bangladesh, the natural abundance of seaweeds is reported from the south-eastern part of the mainland and offshore island, the St. Martin Island. Although the seaweed flora of St. Martin's Island in Bangladesh are extensive, yet they are relatively underutilized. Seaweed research team of Marine Fisheries & Technology Station, BFRI, Cox's Bazar discovered potential natural seaweed bed from Nuniarchara to Nazirartek

areas of Bakkhali river and Moheshkhali Channel estuary of Cox's Bazar. *Hypnea musciformis* and *Enteromorpha intestinalis* etc. are the main available seaweed species of this bed.

Subsequently, economically important *H. cornuta*, *Caularпа racemosa*, *Sargassum* sp. and *Pudina fraseri* were selected for culture experiment in Saint Martin Island. Culture trial also initiated in Bakkhali river and Innani coast at Cox's Bazar. Seaweed seeds (small segment of live seaweed) were collected from natural growing areas of Bay of Bengal coast and attached with coconut rope nets with red cotton fiber during

extreme low-tide period. After 15 days of transplantation the highest weight specific growth rate was found in *Sargassum* sp. from 5.5% to 5.9% per day, followed *C. racemosa* from 4.9% to 5.4% per day, *P. fraseri* from 3.2% to 3.8% and the lowest weight specific growth rate in *H. cornuta* from 0.52% to 0.80%, respectively. Eight edible seaweeds were analyzed to determine its proximate and mineral compositions. The protein content was found as the highest (5.7 to 22.31 g/100 g) and varied among seaweeds with highest in edible red sea weed *Hypnea* sp. The mineral composition (Ca, K, Na, Fe and Zn) showed higher Ca (2,288.9 mg/100 g), K (98 mg/100 g) and Na (161 mg/100 g) in red seaweed *Jania rubens*, and was followed by *S. oligocystum* with Ca (228 mg/100 g), K (61 mg/100 g), Na (144 mg/100 g) and Fe (21 mg/100 g) values. Processed *Hypnea* and *Pudina* were used as green salad. Inclusion of seaweed in salad also proved enrichment micro-nutrients.

### Shrimp Research Station, Bagerhat

This Station was established in 2011 in an area of 3.24 ha on the bank of Dharatana river which is 2 km away from Bagerhat city with a mandate to carry out demand driven research for development of appropriate technologies for enhancing shrimp production through better health management, disease diagnostics and control, feed and nutrition, post-harvest handling, processing and quality control of shrimp and shrimp-based products. The Station is comprised of a two storied office-cum laboratory building with four well equipped modern laboratories viz. Shrimp Health



Management Laboratory, Quality Control Laboratory, Shrimp Feed & Nutrition Laboratory, and Water & Soil Quality Management Laboratory. The modern equipment like PCR, GC-MS and LC-MS have been installed in the laboratories for effective research. Besides, the station has a prawn hatchery and a complex of nine earthen ponds for conducting outdoor research. There is a 3-storied staff dormitory

and a 4-storied training dormitory for conducting training for dissemination of research-evolved technologies. It has 12 scientists and 35 supporting staff. The station has been conducting research on the use of hazardous chemicals and antibiotics in shrimp culture, application of probiotics, development of shrimp feed, control, management of shrimp disease etc.

### **Significant Research Achievement**

- Development of protocol for improved management technique of prawn seed production.
- Identification of different hazardous chemicals and antibiotics used in shrimp & dried fish.
- Identification of risk factors for White Spot Syndrome Virus (WSSV) infection in giant prawn, *Macrobrachium rosenbergii*.

### **National and International Awards and Honor Received by BFRI/Scientists**

The relentless efforts made by the institute and its scientists in R&D led the institute to evolve many important aquaculture technologies and open water management guidelines. Due to use of these improved aquaculture technologies and implementation of the management guidelines, fish production of the country since inception of BFRI in 1984 has increased five folds from 0.8 m tons in 1985 to about 3.9 m tons in 2015. The country has accomplished silver revolution. The institute and its scientists have received many awards and honor from the Government and various national and international organizations in recognition of their contribution in various field of fisheries R&D. A list of awards and the awardees are given below:

- National Fisheries Gold Medal Award 1997 received by BFRI for contribution in fisheries and aquaculture technology development.
- Twentieth Century Achievement Award 1997 of American Biographical Institute received by Dr. M.A. Mazid for admirable contribution in professional field.
- National Fisheries Gold Medal Award 1999 received by Dr. M.A. Mazid for scientific and technical publication on fisheries and aquaculture.
- Cambridge International Award 1999 of Cambridge Biographical Center, UK received by Dr. M.A. Mazid for scientific contribution.
- National Fisheries Gold Medal Award 2002 received by Dr. A.H.M. Kohinoor for development of breeding technology of Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*).
- National Fisheries Bronze Medal Award 2002 received by Dr. Durin Akhter Jahan for contribution in Farming System Research & Development.
- National Fisheries Gold Medal Award 2003 received by Dr. M.G. Hussain for contribution in fisheries research.
- National Fisheries Gold Medal Award 2004 received by Dr. M.A. Mazid for contribution in publication of fisheries and aquaculture technologies.
- National Fisheries Silver Medal Award 2004 received by Dr. G.C. Haldar for research publication.
- National Bronze Medal Award 2005 received by Dr. Md. Enamul Hoq for research publication.
- National Gold Medal Award 2009 received by Dr. Md. Jahangir Alam for development of breeding technology of nona tengra (*Mystus gulio*)
- National Gold Medal Award 2010 received by BFRI for its contribution in development of improved breed of Rohu (*Labeo rohita*).
- President Award for Agricultural Development 1995 received by Dr. Md. Khalilur Rahman for contribution in Pangus breeding.

### List of BFRI Publications

BFRI has so far published 33 Research Reports, 45 Extension Booklets, 89 Leaflets, 10 Extension Manuals, 26 Training Manual, 9 Workshop Proceedings, 9 Posters, 16 Brochure and 3 Directory. In addition, BFRI regularly publishes "Fisheries Newsletter" and "Bangladesh Journal of Fisheries" in quarterly and bi-annually, respectively. The list of important publications of BFRI are given below:

#### a) Research Report

1. Survey of potential fish feed ingredients of Bangladesh on the basis of their availability and biochemical composition. 1989.
2. Investigation into the nutritional requirements of major carps (*Labeo rohita*, *Catla catla*, *Cirrhina mrigala* and *Labeo calbasu*). 1992.
3. Integrated paddy-cum-fish/shrimp farming. 1992.
4. Benchmark survey of aquaculture practices, potentials and constraints in Bangladesh. 1992.
5. Limnological studies on Kaptai Lake. 1992.
6. Aquaculture of *Pangasius pangasius*. 1992.
7. Culture of fish in pens. 1994.
8. Socio-economic impact and constraints of shrimp culture in Bangladesh. 1995.
9. Gear selectivity study of floodplain fishery in Bangladesh. 1997.
10. Reproduction areas of Riverine fishes in Bangladesh. 1997.
11. Survey and assessment of shrimp fry and other aquatic resources of Bangladesh. 2001.
12. Development of breeding and culture technique of boal fish (*Wallago attu*). 2001
13. Post flood rehabilitation and adaptive research support project. 2001.
14. Genetic improvement and conservation of carp species in Bangladesh. 2001
15. Investigation on diseases of some small indigenous Freshwater fishes of Bangladesh. 2001.
16. Development of nursery and grow-out systems of local catfish, *Clarias batrachus* in Bangladesh. 2001.
17. Improving soil, water and productivity of gher fishery. 2001.
18. Freshwater pearl culture: principles and techniques. 2001.
19. Sylhet-Mymensingh basin fish stock assessment. 2002.
20. Development of *Macrobrachium* backyard hatchery. 2002.
21. Studies on the impacts of shrimp farming on mangrove and estuarine environment of greater Khulna District. 2002.
22. Fisheries Research Perspective Plan 2001- 2020. 2003.
23. Fish feed reference standards for Bangladesh. 2004.
24. Present status, problems and management of carp species in the River Halda (In Bangla). 2007.



25. Sustainable management strategies for fisheries resources of Kaptai Lake (in Bangla). 2008.
26. Sustainable Management of Fisheries Resources of the Bay of Bengal. 2010.
27. Marine Fisheries of Bangladesh: Prospect & Potentialities. 2010.
28. Nutrient composition of small indigenous fish species of Bangladesh. 2011.
29. Coastal and marine fisheries resources management and conservation (in Bangla). 2012.
30. Bay of Bengal, Bangladesh: Fish & Fisheries. 2014
31. Sharks, Skates and Rays of Bangladesh. 2014.
32. Diversity of adaptive fishing gears and their impact on Riverine fisheries and environment. 2014.
33. Impact of aquaculture drugs and chemicals on aquatic ecology and productivity. 2014.

#### b) Proceedings

1. Proceeding of the SAARC workshop on fish seed production. 1989.
2. Proceeding of the workshop on sustainable development of marine fisheries resources in Bangladesh. 1995.
3. Hilsa fisheries research in Bangladesh. 1998.
4. Review of the recommendations of national seminars and workshops on Fisheries (1994-99) (in Bangla). 2001.
5. Genetic management and improvement of exotic carp species in Bangladesh. 2002.
6. Shark Fisheries in the Bay of Bengal, Bangladesh: Status and Potentialities . 2011.
7. Ecosystem Health and Management of Pollution in the Bay of Bengal. 2011.
8. Integrated Coastal Management (ICM) in Bangladesh. 2012.
9. Sundarbans Fisheries of Bangladesh: Current Status and Potentialities. 2012

#### c) Directory

1. Directory of Fisheries Research in Bangladesh. Part-I : Inventory of Fishereies Scientists, 1990.
2. Directory of Fisheries Research in Bangladesh. Part-I I; Abstract bibliography on fisheries research, 1991.
3. Training Directory. 2006.



## BFRI Personnel

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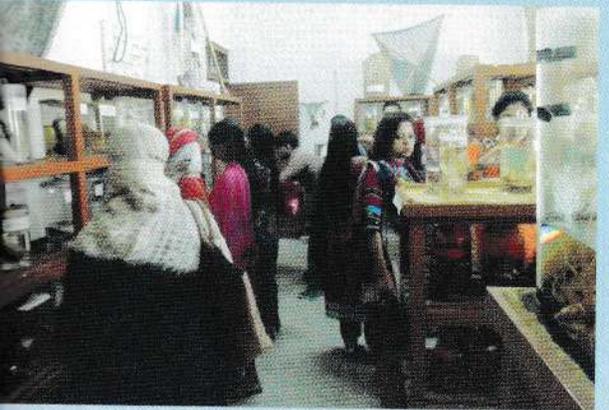
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