

## Review Article

# Fisheries and Aquaculture in Bangladesh: Challenges and Opportunities

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Submitted: 07 April 2014

Accepted: 07 June 2014

Published: 09 June 2014

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## Keywords

- Fisheries
- Bangladesh
- Food security
- Nutrition security
- Water pollution
- Community based fisheries management

**Abstract**

The purpose of this paper is to review the performance of fisheries sector in Bangladesh and the challenges it is facing. Data and information were sourced from the publication of the Department of Fisheries (DoF) and related non-published grey literature. Bangladesh is predominantly an agrarian economy and is naturally endowed with a huge sweet water resources and the world's longest continuous sea beach. With the world's largest flooded wetland, the third largest aquatic biodiversity in Asia behind only to China and India, Bangladesh is considered as one the most suitable region for aquaculture and fisheries in the world. The country has an inland water area of about 45,000 km<sup>2</sup> and about 710 km long coastal belt. Given this extensive water resource, it is evident that fisheries play an important role in the economy and the diet of the population. Fish and fish products supply 60 percent of animal protein and around three percents of total export earnings. In recent years, however, the fisheries sector is confronted with challenges posed by numerous natural and anthropogenic causes such as climate change, natural disasters, unbalanced urbanization and industrialization, overfishing and environmental pollution. The combined effect of these factors is posing significant threat to the income and food security of the population and urges for immediate actions by government and policymakers.

**ABBREVIATIONS**

CBFM: Community Based Fisheries Management; CBOs: Community Based Organizations; DfID: Department For International Development; IUCN: International Union for Conservation of Nature; DOF: Department of Fisheries; NGOs: Non-Governmental Organizations

**INTRODUCTION**

Fish is the second most valuable agricultural crop in Bangladesh and its production contributes to the livelihoods and employment of millions of people. The culture and consumption of fish therefore has important implications for national income and food security. Bangladeshi people are popularly referred to as "Mache Bhate Bangali" or "fish and rice makes a Bengali".

The fisheries sector in Bangladesh is broadly divided into four sub-sectors- inland capture, inland culture, mariculture (artisanal fisheries) and marine industrial fisheries. Bangladesh is one of the world's leading inland fisheries producers and has a huge water resource all over the country in the form of small ponds, ditches, lakes, canals, small and large rivers, and estuaries covering about 4.34 million hectares. Freshwater aquaculture involves pond aquaculture especially the polyculture of native

and exotic species. The country also has a coastal area of 2.30 million ha and a coastline of 714 km along the Bay of Bengal, which supports a large artisanal and coastal fisheries. Bangladesh is considered one of the most suitable countries in the world for farming of freshwater prawn (*Macrobrachium rosenbergii*) [11].

Bangladesh is one of the resourceful countries with its wide range of marine aquatic bio-diversities. There are about 1093 marine aquatic organisms where 44.35% are finfish, 32.23% shellfish, 15.10% seaweeds and only 8.32% are other organisms including shrimps. In 2011, an area of around 276,492 ha was used for prawn and shrimp cultivation [3]. Aquaculture production in Bangladesh has shown an average growth of 28 percent from 0.12 million tonnes to 0.66 million tonnes during the period 1985 to 2000. Despite that, Bangladesh has so far realized only a fraction of its production potential.

Bangladesh has some 130 deep-sea fishing trawlers, 22000 mechanized fishing boats, and 25000 non mechanized fishing boats. Currently there are 133 fish processing plants in Bangladesh which are mostly located in port cities (Khulna and Chittagong) of which 74 processing plants are EU approved. Though the country is endowed with enormous fishery resources which are vital to the livelihood of millions of people and national food and nutrition security, the sector is facing major constraints including climate

change, poor fisheries infrastructure, resource mismanagement, water and environmental pollution, natural disasters such as recurrent flood and cyclones, and lack of knowledge among farmers. Bangladesh is working with close collaboration with Department for International Development (DFID), World Fish Center and other international organization to develop the sector by building research partnerships and increasing investment. Community based management of fisheries is proving its potential to avert the longstanding political challenges farmers have been facing. The country, however, faces urgent imperatives to strengthen environmental laws to curb pollution which is significantly compromising the performance of the fisheries sector.

### Importance of fish export in the economy

Fisheries and aquaculture sector have emerged as the second most important contributors in export earnings of Bangladesh. It is the second largest export industry in Bangladesh and produces 2.5 percent of the global production of shrimp. Though rice is the most widely produced agricultural crop in Bangladesh, fisheries has a unique feature for its role in providing an important source of animal protein and essential elements for the population. In 2010-2011, some 5.5 million people were directly involved in fisheries as the main source of earning. Table 1 shows the trend in export of fish products.

Bangladesh is considered one of the most suitable countries in the world for prawn and shrimp farming, because of its vast resources of shallow water bodies which provide a unique opportunity for prawn and shrimp production [1,2]. Prawn farming has brought about dramatic improvements in the livelihoods of the coastal poor, including women. During the 1990s, the rapid development of prawn farming in southwest Bangladesh has been likened to a "blue revolution" [7]. The migration of poor communities from the coastal region to the urban areas has reduced thanks to improved livelihood opportunities brought about by prawn and shrimp culture. The industry accounted for 22.21% of total agricultural GDP and 2.73% of total export income during the year 2011. USA and EU together account for around 80% of the total shrimp export. In 2011-2012, the European Union made up most of Bangladesh's yearly US\$500,000 shrimp export.

### Trend of fish production in Bangladesh

Bangladesh ranks third among the world's largest inland fish producing countries after China and India. Table shows the trend in aquaculture production since. Around three quarters of rural households practice some form of freshwater aquaculture

covering some 10 million ponds and most of which measure less than 400 m<sup>2</sup>.

Inland pond culture represents the most important part of aquaculture in Bangladesh contributing to around 86% of total production. Aquaculture accounted for about 43.5 percent of the total fish production during 2003-04, with inland open water fisheries contributed 34.8 percent. Fisheries in Bangladesh are diverse and there are about 795 native species of fish and shrimp in the fresh and marine waters. Besides that, there are 10 species of pearl bearing bivalves, 12 species of edible tortoise and turtle, 15 species of crab and 3 species of lobster. Most of the prawn and shrimp farms (~75%) are located in southwest part of the country, mainly Bagerhat, Khulna and Satkhira districts, with the remainders in the southeast region including Cox's Bazar and Noakhali district. In 2003, more than 0.6 people are engaged in shrimp farming activities [21].

Although inland capture dominate total production, aquaculture production has increased significantly with a threefold rise during the period between 1989 to 1999 [15]. The contribution of cultured ponds also increased substantially from 27% in 1984 to 52% in 1996 [16]. Production of shrimp has increased from 11,000 to 94,000 tonnes, recording an average annual growth of 45 percent during the same period [25]. In 2012, fish production reached a new record 3.22 million tonnes which was 5.2% higher than the previous year.

Hilsha (*Tenualosa ilisha*) is one of the most favorite fish species in South Asian fish consumers and is recognized as the national fish of Bangladesh. Despite being a marine fish, the Padma-Meghna-Jamuna delta is the main site for hilsha capture where they migrate for laying eggs. Hilsha contributes to nearly 16.4% of the country's total fish production. Though Bangladesh produces about 350,000 tonnes of hilsha fish annually, the amount is found to be decreasing in recent years due to conservation purposes.

### Role of fish in diet

Fish is the primary source of animal protein for Bangladeshi population, especially poor rural households. Fishes are the major source of animal protein providing 80% of the animal protein intake and 7% of total protein supplies. Rice and fish constitute such an important part of Bangladeshi food culture that it has become a popular proverb- "mache bhate bangali," which means "fish and rice make a Bengali. In terms of weight, fish is the third most widely consumed food nationwide. But consumption pattern tends to vary among urban and rural areas and is shown to be lower among female members [13]. Per capita annual fish consumption in Bangladesh is about 14 kg against a

**Table 1:** Export of Fish and Fish-Product from Bangladesh.

Year	Frozen Shrimp/Prawn		Frozen Fish (Others)		Dry fish	
	Quantity (MT)	Value(Crore taka)	Quantity (MT)	Value(Crore taka)	Quantity (MT)	Value(Crore taka)
1992	19224	604.03	2704	38.31	1042	12.26
1995	25225	1106.39	8827	176.62	521	8.39
2000	29713	1885.15	9484	137.19	215	3.65
2005	46533	2281.6	15763	256.20	272	3.71
2009	50368	2744.12	19294	450.89	341	11.99

Source: DoF, 2009.

recommended minimum requirement of 18 kg/year. From the last national survey in rural Bangladesh, the mean total protein intake was 48 g/person/d, of which fish contributed 3 g [17]. Table 2 shows the contribution of fisheries sector in national food supply.

### Prospects of integrated fish farming

Though rice monoculture is the main characteristic of Bangladeshi agriculture, rice-fish farming began to receive attention in the 1980s [23]. Integrated rice-fish farming offers better resource utilization, diversity and food supply as well. In Mymensingh district, which is considered as one of the rice bowls of the country, has been identified as the most important region for integrated rice-fish culture due to its favorable climatic conditions and availability of low-lying agricultural land. Though currently a small number of farmers are practicing this method, it has been reported that the cultivation of fish in rice fields increases rice yields by 8 to 15% and thus the scope of rice cropping with integrated fish farm is remains considerably wide [25]. Integrated fish farming can fully utilize the water body, the water surface, the land, and the pond silt to increase the food available for human consumption. Integrated farming reduces the need for pelleted grains, which is both economical and create less pressure on total grain supply for human consumption. Rice-fish farming is also being regarded as an important approach to integrated pest management (IPM). Integrated rice-fish farming is most technically and cost efficient, using the least inputs, in particular fertilizer and provides a sustainable alternative to rice monoculture. Researchers also suggest that integrated rice-

fish farming system is better than rice monoculture in terms of a range of social, economic and environmental measures [24].

Green revolution (GR) worldwide has increased staple crop production and greatly contributed to combat global hunger. However, now when the long term repercussions of GR are understood such monoculture, soil degradation, and extensive use of agrochemicals, all of which have had serious negative impacts on fisheries production, there is an imperative felt by agriculturists to find more sustainable strategies to reduce these negative impacts. Bangladesh has seen a dramatic rise in national rice production. Many watery areas have been brought under staple crop production to meet the demand of the huge population. Though fish production has also increased, but the its still far below the real potential of the country. Rice-fish farming can boost the production of both items which will help the country to improve food and nutrition security. The demand for rice and fish is constantly rising in Bangladesh with nearly three million people being added each year to its population [21]. Integrated rice-fish farming can help Bangladesh keep pace with the current demand for food through rice and fish production.

Increasing population translates to increasing demand for food and more pressure on land and water. If sustainable policies are not taken, rice demand may continue to compromise fisheries output in Bangladesh. Although official figures show that the number of floodplain fisheries increased in the 1990s, after decreasing in the 1980s, it is widely held that floodplain catches have been falling. Agricultural intensification has been proposed by researchers to meet the rising food demand for the huge population in Bangladesh. While rice production is still

**Table 2:** National Fish food supply (tonnes).

Items	1980	1990	2000	2005	2007	2009
Freshwater Fish	521,450	675,596	1,376,081	1,810,458	2,015,331	2,235,742
Marine Fish	40,106	51,018	72,506	130,618	120,840	203,513

Source: DoF, 2010.

**Table 3:** Annual growth rate of fisheries sector, 1994-2003.

Year	1994-95	1996-97	1998-1999	2001-02	2002-03
Growth(%)	6.79	7.6	9.96	2.22	2.33

Source: DoF 2005.



**Figure 1** Inland aquaculture has improved the economic condition of many rural households.

**Table 4:** Shows the contribution of homestead pond aquaculture to household income and mean size of operation.

Source	Aquaculture as % HH income	Mean pond size (ha)
Thompson et al. (2006)	3	0.09
Jahan et al. (2010)	10	0.1
Hossain et al. (2010)	10	0.04
Winrock International (2004)	13.2	0.08
Karim (2006)	15.5	0.1-0.2

likely to increase, its also possible that it'll come at the expense of diminishing resources for fish production.

### Challenges for fisheries sector in Bangladesh

The fisheries industry in Bangladesh is confronted with a range of economic, institutional and environmental concerns. According to a IUCN(International Union for Conservation of Nature) study, 54 floodplain fish species are in danger of extinction and the pressure of fishing is so heavy in the floodplains that less than 2% of produced fish survives the end of each year. Table 3 shows that growth in fish production has slowed since 2000. Recurrent floods and natural disasters are believed to be main underlying causes behind this slump. Bangladesh is a low-lying land which makes it extremely vulnerable to sea-level rise, and is ranked first among countries to be affected by the adverse effects of climate change [4]. Nearly 80% of total area in Bangladesh is regarded as floodplains, and its precarious geographical position makes it highly prone to natural disasters as well. Climate change have devastating impacts on fishery-based livelihoods and on domestic food supply. Vulnerability of fishery-based livelihoods may substantially increase in the coming decades due to climate change, and in the absence of adaptation, increased frequency and intensity of cyclones and floods would result in greater damage to fishing materials and loss of fish [27].

Mariculture is also at risk of increasing salinity and over-fishing. According to FAO, globally, around a quarter of all fish stocks are overexploited and half of them are fully exploited. In Bangladesh, marine capture represents about 20% of total fish production. The floodplain and marine fisheries are under serious threat from overfishing. Overexploitation in the coastal region poses significant challenges on marine living resources and increases the dependency on distant water fishing in the long run.

Water pollution is another growing threat for the future of fisheries sector in Bangladesh and is fast becoming a serious public health issue and a constraint for food production. Industrial(especially textile and tannery) effluent, fertilizer and pesticide run-off, poor sewerage infrastructure and improper disposal of household waste are the major causes of water pollution in Bangladesh. Rivers and canals near the urban areas are threatened by sedimentation and siltation due mainly to soil erosion, and compounded by industrial expansion, most of these water bodies have already become to polluted to support biological system. Poor urban and industrial management and lack of enforcement of environmental laws are contributing to this pollution spree. The Buriganga river that flows through the

capital city is the most polluted river in the country, many parts of which have already turned coal black.

Besides these natural and chemical events, inadequate financial capacities, poor resources management and lack of research facilities are also responsible for underperformance of the fisheries sector and environmental degradation [20]. Researchers have shown that poor management of prawn and shrimp culture is having devastating effects on the Sundarbans (the largest mangrove forest in the world) [5] where an estimated 9700 ha of the forest-mass has been lost as a result of intense shrimp farming [6]. Conversion of many natural wetlands to prawn farms has resulted in impediment of water flows and also decreased the scope of migration for many fish species [8].

### Community-based fisheries management, window of Opportunities

The Community Based Fisheries Management (CBFM) project was founded with an ambition to promote sustainable use of inland capture fisheries by empowering fisher's communities to manage their own aquatic resources [19]. Most fishers in rural Bangladesh operate on a small-scale basis(Table 4). Poor fishers suffer disadvantaged situations due policies that favor powerful players in the sector [18]. The CBFM initiative has developed a series of fisheries management approaches for ensuring equitable access to fisheries resources for community-based organisations (CBOs). Founded in 1994, the project supported by Department for International Development(DfID) and implemented by Bangladesh's Department of Fisheries(DoF) in partnership with the WorldFish Center and 11 NGOs adopted a research-based approach to promote equitable access and sustainable management of inland fisheries resources and to be run by the CBOs [14]. So far, a total of 164 fish sanctuaries have been established in over 80 water bodies under the CBFM approach. The project involved 14,000 CBO group members and a further 9,000 direct beneficiaries. In a survey conducted in 2007, the majority of CBOs reported increases in total production despite a 30 per cent increase in the number of fishers by then. Thus it appears that community-based fisheries management can offer significantly better utilization of the public water bodies covering over 4 million ha of floodplain wetlands in the country.

### CONCLUSIONS

This article gives an overview of the fisheries sector and its challenges and opportunities in Bangladesh. It is evident that the performance of fisheries sector is crucial from a national macroeconomic and food and nutrition security perspective. Therefore it proposes that a more efficient and sustainable management of the aquatic resources will contribute greatly to health and economy of the country. Policy makers must spare no effort to ensure the functioning of this sector in full swing by enhancing investment and research infrastructure, more strict environmental policies, and introducing better storage and marketing facilities. More importantly, the situation of fishers must be taken into account and special task force should be build to assess their vulnerability and strategies to tackle them. In order to meet the soaring demand for food for the burgeoning population, there is a need for increased rice and fish production in Bangladesh. But attention should also be given to the negative



environmental externalities such as land and water biodiversity and water and air pollution which is inextricably linked with the success of agricultural sector.

## ACKNOWLEDGEMENTS

We extend sincere thanks to World Fish Center for giving permission to reuse the photographs.

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### Cite this article

Ghose B (2014) Fisheries and Aquaculture in Bangladesh: Challenges and Opportunities. *Ann Aquac Res* 1(1): 1001.