Chapter 2

SECTOR OVERVIEW AND STUDY DESIGN

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Sector Overview

Importance of the Sector

The fisheries sector in Bangladesh is important in terms of both economic and food security perspectives. The sector accounts for about 4 percent of national gross domestic product (GDP), 23 percent of the agricultural GDP, and about 3 percent of total foreign exchange earnings (Bangladesh, DoF 2015). In terms of employment, the sector's role in the economy is even larger. About 17.8 million Bangladeshis, including 1.4 million women, find jobs (full time and part time) in the sector (FAO 2016), which translates to about 11 percent of the total population and more than 23 percent of the working population.[1] Fish also occupies an important place in Bangladeshi diets and culture—so much so that there is a Bengali (both Bangladesh and Indian West Bengal) adage that says *mache bhate bangali* (meaning "fish and rice is what makes a Bengali"). The role of fish in improving food security of the poor is even greater. Fishing is an important source of livelihood for the poor, and it is often their only source of protein. It is estimated that about 70 percent of the rural population engaged in fishing for subsistence at some point in the year (FAO 2014).

The sector is also the second largest export earner, next to readymade garments, equaling about 18 percent of GDP (Taslim and Haque 2011). More important, although the sector grew by about 6 percent over the past 10 years, there is still large potential for future growth in production and exports. The country's Seventh Five Year Plan (2016–2020) has set five goals to this end—namely, increased production and export, increased conservation of aquatic diversity, enhanced coastal and marine fisheries, equitable income generation, and improved safety (Bangladesh, Ministry of Planning 2015). The first and

1 According to World Bank (2017), the dependency ratio is 51.4, which means the working population is 48.6 percent.

the fifth goals appear to have been particularly designed for export promotion objectives. These goals set the targets of increasing aquaculture production by 45 percent, increasing fish farmers income by 20 percent, and increasing export earnings to US$1.25 billion by 2020. In addition, the plan aspires to achieve good aquaculture practices (GAP) and good manufacturing practices (GMP) at all stages of the value chain to comply with the standards of international markets. These are ambitious targets that might not be met by 2020, but as discussed below, the country certainly has the potential to achieve them.

Opportunities and Challenges

The fisheries sector in Bangladesh consists of three main subsectors—inland capture, inland culture (aquaculture), and marine. Historically, inland capture and marine used to be the dominant subsectors. In fact, aquaculture was the smallest subsector until the 1980s, accounting for only about 16 percent of total fish production. Things started changing rapidly by the turn of the century, and aquaculture became the largest among the three subsectors. In terms of volume, the average annual production of culture fish averaged only 178 thousand metric tons from 1983–1984 to 1992–1993, but jumped to more than 2 million metric tons by 2014, representing about 69 percent of total fish production in the country (Table 2.1).[2]

Disaggregated estimates of water area and production of fish provide important insights into the recent trend as well as future opportunities and challenges. The numbers in Table 2.1 clearly suggest that the main driver of growth in culture fisheries has been cultivation in ponds. In 2015, production from ponds accounted for more than 70 percent of inland culture and 40 percent of total fish production. Historically ponds have been an important part of Bengali culture—they have served as both private and common property for bathing as well as production and consumption of fish. Three general styles of fish production exist: (1) extensive (traditional method with "no intentional nutritional inputs"), (2) semi-intensive (rely on natural food and supplementary feed), and (3) intensive ("depend on nutritionally complete diets added to the system") (Edwards and Demaine 1998). Previously production systems were traditional and households never used improved seeds and feeds. Gradual moves toward intensification and commercialization that occurred toward the end of the last century triggered the growth in the subsector.

2 All statistics presented in Table 2.1 are the authors' calculations based on Bangladesh, DoF data.

TABLE 2.1 Area and production of fish in Bangladesh, 2014–2015

Subsectors	Water area (hectares)	Percentage of total (capture + culture)	Production in 2015 (metric tons)	Shares (capture + culture) (%)
Inland capture				
Beel	114,161	2.4	92,678	2.8
Floodplain	2,692,964	57.2	730,210	22.1
Kaptai lake	68,800	1.5	8,645	0.3
River	853,863	18.1	174,878	5.3
Sundarban	177,700	3.8	17,580	0.5
Capture total	*3,907,488*	83.0	*1,023,991*	31.0
Inland culture				
Baor (Oxbow lakes)	5,488	0.1	223,582	6.8
Cage culture	10	0.0	1,969	0.1
Pen culture	8,326	0.2	16,084	0.5
Pond culture	377,968	8.0	1,610,875	48.8
Seasonal water body	133,330	2.8	201,280	6.1
Shrimp/prawn	275,583	5.9	223,582	6.8
Culture total	*800,705*	17.0	*2,277,372*	69
(Capture + culture)	*4,708,193*	100.0	*3,301,363*	100
Marine				
Industrial	—		84,846	14.1
Artisanal	—		515,000	85.9
Marine total	—		*599,846*	100
Country Total	**4,708,193.00**		**3,901,209.00**	

Source: Compiled from the Bangladesh, DoF (2015) and FAO (2016).
Note: — = data not available.

However, there is large potential for further growth in pond culture in three important ways. First, the culture fisheries in Bangladesh are largely extensive (traditional, whereby fish feed entirely from the food web within the pond) or improved extensive (traditional with some supplemental feeding), with a limited number of semi-intensive or intensive systems (fish are dependent on the feed provided and water must be replenished at a high rate to maintain oxygen levels and remove waste).[3] As a result, overall productivity is much lower relative to many Asian countries. For instance, per hectare shrimp production in Bangladesh is only about 786 kilograms, which is only about 26 percent of the 3 metric tons per hectare in both Vietnam and Thailand.

3 The definition of the farming system is obtained from EC (2012).

Productive varieties, such as pangas and tilapia, are growing but remain a small share of total area under aquaculture. For a handful of commercial farmers who use an intensive system for these varieties, productivity per hectare is reported to be 60–70 metric tons (Edwards and Hossain 2010), which is incredibly low when compared to more than 240 metric tons in Vietnam (Phuong et al. 2007).

Second, with economic growth, rice consumption in Bangladesh has been declining in recent years. For instance, according to a recently published Household Income and Expenditure Survey (HIES) report, per capita daily rice consumption in Bangladesh has declined from 416 grams in 2010 to 367 grams in 2016, equivalent to about a 2.7 percent annual rate of decline. The reduction in rice consumption in rural Bangladesh is even higher—from 442 grams in 2010 to 386 grams in 2016, or about a 3.8 percent rate of decline—during the same period (BBS 2017). This trend implies that there will be opportunities to convert paddy land to pond culture or to diversify into other crops. Finally, despite the country's huge water bodies, rivers, and coastline, cage culture and coastal aquaculture are practically nonexistent. If the barriers to exploiting this opportunity (for example, a sound regulatory environment for cage culture; access to credit; and availability of seed, feed, and other technology) are alleviated, and if their viability is enhanced, it will give an additional boost to aquaculture production.

The fisheries sector in Bangladesh faces serious challenges. A list of these challenges included in the official reports of the Department of Fisheries (DoF) can be grouped into three broad categories: (1) productivity, (2) habitat degradation and negative externalities, and (3) institutional and regulatory challenges. The official sources identify productivity challenges mainly with the scarcity of quality seed, feed, and other inputs. However, productivity enhancement is also constrained by enforcement of property rights in common pool resources. For instance, 3.9 million hectares of the total of 4.7 million hectares, equivalent to 83 percent, are under capture fisheries. Most of these lands have common property elements and hence suffer from classic "tragedy of commons" problems. While regulations can limit open access, achieving full productivity potentials can be challenging. The challenges related to habitat degradation and other environmental consequences are highlighted in the Seventh Five Year Plan. In fact, the plan is to help at least 75 percent of the endangered inland water species in designated sanctuaries reappear by 2020. Similarly, there are policies to restrict marine catches to help grow certain species, such as ilish, which was chronically declining until recently. Thanks to a government program called "Jatka [young ilish less

than 10 inches in length] Preservation," production figures in the past couple of years have seen growth. However, this is not true for other marine fisheries. The regulatory and institutional challenges are at all stages of the value chain—from quality input supply to ensuring food safety for the consumers. The regulatory constraints to input supply (seed and feed) are elaborated in FAO (2016), and the challenges of institutional capacity in extension, quality and safety assurance, as well as enforcement of law are articulated in various reports from the Ministry of Fisheries and Livestock.

Policy Environment

The fisheries subsector policies in Bangladesh have evolved over many decades. Therefore, many rules, acts, and ordinances have been passed by the government over the years. This section presents an overview of the policies, governance, and emerging challenges and strategies in the subsector. Serious policy thinking regarding the fisheries sector in Bangladesh began immediately after Bangladesh gained independence from Pakistan. Between 1950 and 1997, the Government of Bangladesh passed a total of 21 pieces of legislation. A quick review of these documents suggests that the basic act to regulate inland fisheries in Bangladesh is the Protection and Conservation of Fish Act (1950). This act went through several amendments in the subsequent decades. Two of the main amendments are The Protection and Conservation Ordinance (1982) and the Marine Fisheries Ordinance (1983). One striking feature of the fisheries legislation in Bangladesh is that there are no separate sections on aquaculture, although some of the provisions are relevant to the subsector (FAO 2016). For instance, the Protection and Conservation of Fish Rules include protection of carp species, prohibit certain activities, and stipulate that licenses to catch fish can only be issued for the purposes of aquaculture development.

While the country had a wide range of ordinances, rules, and acts, an integrated National Fisheries Policy (NFP) was adopted only in 1998. The document highlights a long list of rather ambitious policy objectives, ranging from promoting economic growth to restoring environmental balance. Given current governance and institutional structure, it is unclear how these objectives can be achieved. The NFP extends to all government organizations involved in fisheries (and to all water bodies used for fisheries), with unclear mandates for any of those public entities. For instance, Section 6 of the NFP presents the details of the policies related to inland closed water fisheries that include 17 different policy actions. Of these 17 action points, 4 are related to addressing

property rights, 3 are related to private-sector development, 2 are related to research, and the remainder fall broadly under training and extension.

Thus the Ministry of Fisheries and Livestock and its implementing arm, the DoF, have a tall order to enact these laws. The DoF has the overall responsibility to both develop and regulate the fisheries sector. While it is supported by two other public entities—analytical support by the Bangladesh Fisheries Research Institute (BFRI) and industry development support by the Bangladesh Fisheries Development Corporation (BFDC)—delivering on the complex mandates entrusted under various policies and strategies is a difficult task. The governance and coordination challenges are obvious from the fact that key pieces of regulations related to feed and hatcheries as well as aquaculture medicinal protocol did not get passed until 2010–2011 and 2015–2016, respectively (Bangladesh, DoF 2016).

New challenges continue to surface. In a recent report the DoF (Bangladesh, DoF 2015) highlights several challenges that have important implications for future growth, sustainability, food safety, and overall governance of the sector. For instance, one of the key challenges is ensuring quality inputs (for instance, seed, feed, and chemicals), which is likely to have serious implications for future growth (FAO 2015). Similarly, habitat degradation, overfishing, and expansion of coastal aquaculture are of concern. Unless these challenges are addressed quickly, they can have longer-term consequences to the environment and biodiversity. There are two challenges that directly link to the overall governance. The first is the poor institutional links among the stakeholders (Bangladesh, DoF 2015), which essentially implies that the execution of the recently passed policies and regulations will be difficult. The other challenge is in data generation and management. While the DoF maintains times series data on prices and production, it uses an old survey framework that was devised in 1983–1984 when aquaculture was in its infancy. Given all the changes in the sector, much richer data generation, management, and analysis needs to be instituted to formulate evidence-based policies that can tackle the emerging challenges effectively.

Study Design and Data

The Process

The design of the study began with a reconnaissance trip and stakeholders' consultation initiated under the Policy Research and Strategy Support Program (PRSSP) of the International Food Policy Research Institute

(IFPRI) in Bangladesh. The initial plan was to produce a value chain report for the project. However, it became clear from early consultations that there is much to be analyzed to better understand the transformation in aquaculture in Bangladesh. The knowledge gaps in three areas became obvious. First, the review suggested that there was no systematic assessment, based on a large sample, of the aquaculture value chain in Bangladesh. Second, even though the NFP repeatedly highlighted the importance of poverty and food security for promoting aquaculture, to the best of our knowledge, there were no studies assessing the poverty and food security impacts. Finally, it also appeared important to assess prospects of further growth of the sector.

Addressing these questions involved the compilation of a large volume of secondary data, use of existing nationally representative surveys and generation of data with special surveys, and the application of a mix of analytical methods, including econometrics, microsimulation, and multimarket models. Two large datasets have been used. The first is a specially designed stacked value chain survey as proposed in Reardon et al. (2012). This survey combined both mesodata and microdata and has been the basis of analysis on value chain transformation (Chapter 3) and cluster formation (Chapter 4). The analysis of poverty impacts, and demand and supply projections, however, had to be based on nationally representative surveys along with other secondary data. Therefore several rounds of the Bangladesh HIES have been used for these two sets of analysis. A central part of the study is the design and implementation of the value chain survey. Brief descriptions of these surveys are provided below.

The Value Chain Survey

Administering this survey involved developing a sampling framework that can capture a representation of all actors in the value chain (VC). To do this, a large volume of data was gathered for developing a sampling frame and site selections. Based on this initial work, two sets of surveys were conducted: (1) a *microlevel* survey of all key actors in the fish value chain, and (2) a *community-level* survey to gather mesolevel information. Briefly, the sample for the microlevel survey was drawn with a *purposive* stratified random sampling method. The reason for doing a purposive sample is twofold: (1) fish production is concentrated in certain districts of the country, and (2) a nationally representative sample was neither necessary nor financially feasible.

The sample was drawn from 20 districts that fell under four zones (clusters): East (Brahmanbaria, Chittagong, Comilla, Cox's Bazar, Noakhali, and Sylhet districts); North (Bogra, Dinajpur, Gazipur, Mymensingh,

Narsingdi, and Natore districts); Southwest (Khulna, Satkhira, and Bagerhat districts); and South Center (Barisal, Bhola, Chandpur, Gopalganj, and Jessore districts). Cox's Bazar was subsequently dropped from our analysis because we decided to focus on nonshrimp aquaculture in this report. The VC analysis also dropped the interviews with the shrimp farmers and traders from the southern districts. With all these considerations, sampling followed this approach: in each of the districts, a set of subdistricts (upazilas) were randomly selected using probability proportion to size (PPS), which resulted in selection of 102 upazilas in 20 districts (Table 2.2). All mouzas (subunit treated as primary sampling unit [PSU]) in each selected upazila were selected.

Once the PSUs were selected, a census of fish farmers was conducted in each of them and 25 farmers were randomly selected per PSU (20 farmers, plus 5 replacements). The final farm household sample of 77 mouzas (PSU) is representative of 86 percent of the fish pond areas in the districts selected. In turn, the districts selected constitute 61 percent of all pond production in the country. The questionnaires for the survey of each value chain actor were designed to capture all the information necessary to carry out analysis on value chain transformation presented in Chapter 3. The process of questionnaire development involved consulting the IFPRI household, trader, and market surveys in other countries, and the Reardon et al. (2012) questionnaires for the staple value chain study. All questionnaires were programmed in CSPro (Census and Survey Processing System) by an IFPRI programmer to conduct the surveys with computer assisted personal interviews (CAPI) using Mirus tablets. The survey questionnaire for each of the value chain segments included questions that can be grouped into four broad categories: (1) demographic and business characteristics, (2) input supplies, (3) value addition, and (4) marketing of outputs.

The Household Income and Expenditure Survey

The HIES is a nationally representative survey conducted by the Bangladesh Bureau of Statistics (BBS) in five-year intervals. The HIES generates official estimates on income, expenditure, consumption, and poverty situation. The first round of the HIES was conducted in 1973–1974 in the newly independent Bangladesh. Since then, including the latest survey in 2015, the BBS has successfully completed 16 rounds of surveys. Over time, the survey expanded to include additional modules to track many emerging indicators. For instance, the 2010 round of the HIES added four new submodules

TABLE 2.2 Zones and sampled districts

Zone	Districts
East	Brahmanbaria, Chittagong, Comilla, Cox's Bazar, Noakhali, Sylhet
North	Bogra, Dinajpur, Gazipur, Mymensingh, Narsingdi, Natore
Southwest	Bagerhat, Khulna, Satkhira
South Center	Barisal, Bhola, Chandpur, Gopalganj, Jessore

Source: Authors' compilation based on the farm household component of the Bangladesh fish value chain survey conducted by the International Food Policy Research Institute in 2013.

to gather information on microcredit, migration and remittances, shocks and coping, and disability. A big scaling up of the survey occurred during the 2016 round of the HIES, as the government decided to generate many disaggregated estimates, and so the sample size almost quadrupled from 12,240 in 2010 to more than 46,000 in 2016. Unfortunately, these data are yet to be available. Therefore the analysis presented in this book—welfare implications (Chapter 5) and demand system estimates and future projections (Chapter 6)—are based on the earlier rounds.

The HIES follows an elaborate sampling method. Broadly, until the 2010 round the sampling was based on a two-stage stratified random sampling technique, with samples drawn under a framework called Integrated Multipurpose Sample (IMPS). Developed on the basis of the Population and Housing Census 2001, the IMPS design consists of 1,000 PSUs throughout the country. Until the 2010 round there were 640 rural and 360 urban PSUs—defined as two or more contiguous enumeration areas (EA)—each comprised of around 200 households. In the first stage 612 out of a total 1,000 PSUs were drawn from 16 different strata (6 rural, 6 urban, and 4 significant metropolitan area [SMA] strata). In the second stage 20 households were selected from each of the rural, urban, and SMA PSUs. In the 2010 round a total of 12,240 households were sampled, of which 7,840 were rural and the rest resided in urban areas. Following the sample design, the survey is completed in one calendar year (for example, February 1, 2010, to January 31, 2011, in the case of the 2010 round). Thus the survey captures the seasonal variations in a cycle of income, expenditure, and consumption patterns. The survey period is divided into 18 terms, and within each term 34 PSUs are covered to collect data from a total of 680 sample households. In the HIES 2010, 12,240 households were selected, whereby 7,840 were from rural areas and 4,400 were from urban areas.

By combining analyses from various rounds of the HIES and from the primary data collected in the value chain surveys, this book seeks to fill the existing gaps in the literature on fish value chains in Bangladesh. This data provides the opportunity to review historical trends and their determinants, assess the welfare effects, and make projections for future trends and impacts to provide relevant quality policy recommendations to successfully update and complement the current policy environment.

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