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Is Aquaculture Pro-Poor? Empirical Evidence of Impacts on Fish Consumption in Bangladesh

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Summary. — Aquaculture is widely held to contribute to poverty reduction and food security in the Global South, but robust evidence is limited. Using nationally representative data from Bangladesh, this study analyses changes in fish consumption from 2000 to 2010. Rapid expansion of commercial aquaculture pegged down fish prices, resulting in increased fish consumption by extreme poor and moderate poor consumers and those in rural areas. These outcomes are closely linked to the pro-poor nature of national economic growth during this period. These findings contribute to a broadening of the debate on whether the growth of aquaculture in Bangladesh has been pro-poor.

Key words — pro-poor growth, poverty, aquaculture, capture fisheries, Bangladesh, Asia

1. INTRODUCTION

With an average annual growth rate of 8.8% over the last 30 years, aquaculture is the world's fastest growing agro-food sector. Mean annual global fish consumption climbed from 16 kg per capita in 2000 to a record high of 18.6 kg per capita in 2010, as a result of this rapid expansion (FAO, 2012). By 2018, half the fish used for direct human consumption will be farmed (FAO, 2012) and by 2022, aquaculture is forecast to provide an additional 22 million tons of fish; an increase of 35% over current levels (OECD-FAO, 2013). In contrast, the total output of global capture fisheries has remained static for 20 years, and 80% of fish stocks for which data are available are exploited at or beyond sustainable levels (Muir, 2013). A fundamental transition in the structure of the global fisheries sector, from supply dominated by capture fisheries to supply dominated by aquaculture, is taking place (Belton & Thilsted, 2014). This trend is apparent in Bangladesh where, following three decades of sustained growth, aquaculture now accounts for 53% of reported fish production (DOF, 2013).

Bangladesh's wider economy is also undergoing a structural transition (Zhang *et al.*, 2013). Annual GDP growth averaging nearly 6% throughout the decade 2000–10 caused poverty to decline by 1.7% per year, from 49% to 31.5% (BBS, 2011). The number of poor fell from 63 million to 47 million during this period. The depth of poverty (the poverty gap index) was also reduced by nearly half, allowing Bangladesh to attain this Millennium Development Goal target five years earlier than expected (World Bank, 2013). Growth was pro-poor from 2005 to 2010, with households below the 70th percentile of the per capita consumption distribution experiencing the largest relative increases in per capita consumption (World Bank, 2013). These improvements occurred in spite of food price shocks in 2007–08.

Although aquaculture is widely held to contribute to both poverty reduction and food security (Belton & Little, 2011) evidence for this is patchy (Arthur, Béné, Leschen, & Little, 2013), there have been few specific studies of how increases in farmed fish availability affect access and use by poor consumers (Beveridge, Thilsted, Phillips, Metian, Troell, & Hall, 2013), and the effects of the structural transition in fisheries on low-income consumers are poorly understood (Allison, 2011). This is apparent in Bangladesh, where it has been argued that the food and nutrition security implications of the on-going substitution between wild and cultured fish are ambiguous (Belton, van Assledonk, & Thilsted, 2014), and the capacity of aquaculture to meet the consumption needs of poor consumers has long been questioned (Lewis, 1997).

To investigate this dynamic further, this paper analyses whether changes in fish consumption in Bangladesh linked to the growth of aquaculture have been pro-poor, using fish consumption data collected by the Bangladesh Bureau of Statistics for its Household Income and Expenditure Survey (HIES) in 2000, 2005, and 2010. This analysis, which contributes to debates in Bangladesh and more widely on whether the effects of aquaculture's growth have been pro-poor, is unique in utilizing a nationally representative dataset for this purpose, and in drawing explicit links between the outcomes of aquaculture growth and wider changes in a national economy.

The article is organized as follows: First, we summarize debates over the relationship between aquaculture and poverty, provide contextual information on poverty and fisheries in Bangladesh, and define the term "pro-poor." Second, we determine the proportions of fish consumption originating from capture fisheries and aquaculture, and categorize households as "extreme poor," "moderate poor," or "non-poor" according to national poverty lines. Third, we summarize trends in poverty, and identify poverty differentiated changes in the consumption and price of fish from aquaculture and capture fisheries in rural and urban areas from 2000 to 2010. We conclude by summarizing the implications of these findings for poverty and food security and find that, although

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aquaculture growth was pro-poor, this outcome was partly contingent on favorable changes occurring in the wider economy.

2. AQUACULTURE AND POVERTY

(a) *The fisheries sector in Bangladesh*

Bangladesh's fisheries sector (capture fisheries and aquaculture combined) contributed 4.4% of national gross domestic product (GDP) and 25% of agricultural GDP in 2012 (MOF, 2012), with a total output of 3.26 million tons (DOF, 2013). The value of Bangladesh's aquaculture products alone amounted to $3.37 billion in 2011 (FAO, 2013). Production originates from three main sub-sectors: inland capture fisheries, marine capture fisheries, and aquaculture, the respective shares of which are 29%, 18%, and 53% (DOF, 2013). The term "inland capture fishery" refers to the harvesting of self-reproducing fish and prawn populations from open inland water bodies (Ali, 1989). Capture fisheries in Bangladesh are generally characterized by labor intensive small-scale activities, organized at household or community level (Islam & Chuenpagdee, 2013). Seasonal fishing in flooded areas is an important component of marginal and landless household's livelihoods (Lewis, 1997), with more than 70% of rural households reported to participate in fishing for subsistence, income, or both (Halls, Payne, Alam, & Barman, 2008; Shankar, Halls, & Barr, 2004; Thompson, Roos, Sultana, & Thilsted, 2002). Marine capture fisheries are also largely artisanal (Islam, 2003). Pond-based aquaculture producing fin-fish for domestic markets is practiced throughout the country. More than 4 million households engage in "quasi-peasant" forms of production which usually constitute a minor component of diverse agrarian livelihood portfolios, but smaller numbers of more productive "quasi-capitalist" and capitalist producers contribute over two thirds of aquaculture's total output (Belton & Azad, 2012). [1]

Although the rapid growth of these latter forms of production has resulted in large increases in the aggregate volumes of fish produced, much of their areal expansion has taken place through the enclosure and conversion of seasonal floodplains which formerly supported common access fisheries during the monsoon. These changes have resulted in reductions of wild fish biodiversity and biomass, as well as exclusion of poor fishers from access to them (Sultana, 2012). The intensification of agriculture, water control initiatives, road building, urban encroachment, pollution, and increasing fishing effort have also been responsible for major declines in the productivity of inland capture fisheries (Ali, 1997; Belton, Karim, Thilsted, Jahan, Collis, & Phillips, 2011; Halls et al., 2008; Lewis, 1997; Sultana, 2012).

Bangladesh performs poorly on a range of indicators of food and nutrition security (HKI, 2011), and malnutrition is estimated to cost the country $1 billion per year in terms of economic productivity forgone (Howlader, Kavita, Ferdousi, Dipika, Sommerfelt, & Tara, 2012). In this context, changes affecting supply and consumption of fish, whether positive or negative, can have major public health implications. Fisheries are the most important supplier of high quality protein, essential fatty acids, and micronutrients in Bangladesh (Roos, Wahab, Chamnan, & Thilsted, 2007). Fish accounts for the second highest share of food expenditures after rice (Minten *et al*., 2010), and is the most frequently consumed animal-source food across all social strata, as well as the most frequently consumed nutrient rich food (Figure 1). In addition to providing micronutrients which are difficult to obtain from plant-based foods in adequate quantities (Murphy & Allen, 2003), consumption of fish and other animal-source foods increases the bioavailability and absorption of nutrients from plant-based components of the diet (Neumann, Harris, & Rogers, 2001). The very high frequency of fish consumption in Bangladesh, as compared to intakes of all other animal-source foods, makes this dietary function "irreplaceable" (Kent, 1987). Given this context, in the following analysis we consider increases in individual consumption of fish to be *de facto* positive as, unlike many other foods, there are very few negative effects associated with high levels of consumption (Tacon & Metian, 2013).

(b) *Aquaculture—poverty linkages*

Aquaculture has attracted considerable interest as a vehicle for reducing poverty and food insecurity, and a variety of pathways via which the poor might gain from the growth of aquaculture have been identified (Figure 2). Kassam (2013) has also elaborated a similar typology of aquaculture's potential to impact poverty, drawing on the work of de Janvry and Sadoulet (2002) on direct and indirect agriculture–poverty linkages. The main potential benefits stem from improved food supply and/or increased incomes and employment. Benefits may be accessed directly (i.e., by a producer of farmed aquatic products), or indirectly (e.g., through employment in aquaculture value chains, or through increased availability of low-cost fish in local markets) (Edwards, 1999). Ahmed and Lorica (2002) emphasize "income linkages," "employment linkages" and "[food] consumption linkages" as means by which aquaculture can improve food security and reduce poverty. Again, these may be direct (e.g., sale and consumption of self-produced fish by farm households), or indirect (e.g., elasticity effects associated with rising incomes for households adopting aquaculture, or reduced consumer prices due to increased fish supply). Similarly, Stevenson and Irz (2009) identify entry into aquaculture by new producers, employment on fish farms and in associated value chains, and increased supply of fish for consumption by the poor as pathways via which aquaculture may contribute to poverty reduction. A final indirect pathway relates to "consumption linkages" generated by re-spending income from sales of farmed fish on locally produced "non-tradable" goods and services (Delgado, Wada, Rosegrant, Meijer, & Ahmed, 2003; Kassam, 2013; Stanley, 2003).

Ten multi- and bi-lateral donors invested $275 million in 24 aquaculture and capture fisheries projects in Bangladesh during 1990–2003 (Karim, 1998), and numerous additional large sectoral investments have been made since this time. Development interventions such as these have typically promoted "small-scale" forms of aquaculture, and emphasized direct income and consumption effects on poverty reduction (Belton & Little, 2011). Studies which have systematically attempted ex-post impact assessment of such projects have identified broadly positive, if rather modest, effects on household incomes, farm output, and food security (Hallman, Lewis, & Bugum, 2003; Jahan, Ahmed, & Belton, 2010; Rand & Tarp, 2010; Thompson, Firoz Khan, & Sultana, 2006). Lewis (1997) and Belton, Haque, and Little (2012) have both argued however, that the ability of the poorest to gain from this type of aquaculture is constrained in Bangladesh due to extremely high levels of landlessness.

Research exploring the relationship between private-sector-driven commercial aquaculture and poverty has tended to focus on indirect contributions to poverty reduction, with