Chapter 6
Climate Change: Vulnerability and Resilience in Commercial Shrimp Aquaculture in Bangladesh

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ABSTRACT
Global aquaculture is one of the key features of present global agro-food systems. Though aquaculture is one of the fastest growing industries in the world, its growth trajectory is confronted with various challenges including climate disruptions. Since both aquaculture and climate change have regional variations, their interconnections are very complex and require systematic investigation. In various regions of the world, especially in the Global South, aquaculture countries are assessing those interconnections and devising resilience-enhancing programs for the development of the sector. Thorough investigations are required for a comprehensive understanding of the complex interconnections between climate vulnerability and resilience of global aquaculture. Drawing on primary and secondary data from the Bangladesh shrimp sector, and using conceptual lenses of global climate change and resilience, this chapter critically examines how the industrial shrimp aquaculture in Bangladesh is affected by climate disruptions and how the shrimp farming communities address these challenges.

INTRODUCTION
Global aquaculture is one of the key contours in the sociology of global agro-food system. With its increasing role in the world economy and food security in the context of the exhaustion of marine fisheries, global aquaculture demands considerable scholarly attention. Though aquaculture is one of the fastest growing industries in the world, its growth trajectory is confronted with various challenges – a number of which come from global climate change. Since both aquaculture and climate change have regional variations, their interconnections are very complex that require systematic investigation. In various regions of the world, especially in the Global South, aquaculture countries are assessing those interconnections and devising resilience-enhancing programmes for the development of the sector. Thorough investiga-
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From economic crisis to climate disturbances, the challenges for humanity today are varied and interlinked (FAO, 2012). Climate change is no longer viewed only as a potential threat, it is an unavoidable real-life event; an outcome of 200 years of excessive green-house gas (GHG) emissions from fossil fuel combustion in energy generation, transport and industry, deforestation, and intensive agriculture (IPCC, 2015; Williams & Rota, 2013). For ecological, physical and social systems and communities, climate change implications are intense and unsettling. Climate change impacts human communities in many ways – the majority of which are compound, indirect, and ambiguous (Pelling, 2011), so that scientific exploration of the total dynamics becomes problematic. The scientific community now warns that global climate change will have unprecedented repercussions on the natural setting of the earth, flora and fauna, and human life and activities (Islam, 2013; McKinnon, 2012; MoEF, 2009; Pelling, 2011; UNEP, 2010; World Bank, 2013).

Climate disruptions act as external stresses and perturbations to ecological and social systems or communities making them vulnerable. Only a resilient system (or community) can successfully overcome stresses including climate disruptions. Resilience to climate change of a community can be defined as a combination of resistance to frequent and severe disturbances, capacity for recovery and self-organization, and ability to adapt to new conditions (IPCC, 2007). In other words, with regard to climate change, resilience denotes the capacity of a community to absorb shocks posed by the global climate change. Enhancing resilience of a climate-challenged community is a core element of disaster management and risk reduction.

As climate change is a brute reality in the twenty first century, every ecological, social, and social-ecological system adopts its own resilience strategies in order to address climate perturbations. Global industrial aquaculture serves as an excellent case in point to examine the resilience and climate change issues. Industrial aquaculture is a prime candidate for further exploration, because in addition to nutritional and other qualities of fish protein, this sector nurtures some notable socio-economic, political, and environmental concerns around the globe. Firstly, fisheries and aquaculture contribute, directly or indirectly, to livelihoods of an estimated 660–820 million people, or about 10–12% of the world’s population (FAO, 2012, p. 10). The number of fishers in the world has grown by 400% since 1950, compared with a 35% increase in the number of agricultural workers over the same period (World Bank, 2005, p. 5). Secondly, fisheries and aquaculture are central to the food security of many of the world’s poor. Globally, fish provides about 3.0 billion people with almost 20% of their intake of animal protein, and 4.3 billion people with about 15 percent of such protein (FAO, 2012, p. 5). Thirdly, wild capture fisheries have reached or possibly exceeded their sustainable limits; while aquaculture production has increased at about 8% per annum (Boyd & McNevin, 2012; Natale et al. 2013). Thus, aquaculture’s share in total global fish supply is increasing steadily. While in 2004, for example, aquaculture accounted for 32% of entire fish supply (Brander, 2007, p. 19709), it increased to 41% in 2011 (FAO, 2012, p. 3). The entire increase in future demands for fisheries products and a significant quota of total global protein supply must come from aquaculture. Fourthly, industrial aquaculture products, as part of fish and fishery products, are among the major high-valued transnational agro-food commodities (Islam, 2014). Among all globally traded food items, fish and fishery products are ranked first, accounting for about 10% of total agricultural exports (FAO, 2012, p. 14), with a value of USD $125 billion (Bush et al., 2013, p. 1067). Fifthly, changing food habit in the Global North is especially driving the cultivation of specific aquaculture species in the Global South. For example, shrimp, treated as a luxury seafood item, is the most popular