CHAPTER 1

1. INTRODUCTION

The alluvial floodplains in eastern-northeastern India that lie south of the foothills of the Himalaya and north of the Brahmaputra river basin are called the Dooars**.** This region forms the gateway to Bhutan. This region stretches from the Teesta river, West Bengal to the river Dhansiri in Assam. The river Sankosh divided the Dooars into eastern and western Dooars. The Eastern Dooars are known as the Assam Dooars, and the Western Dooars are called the Bengal Dooars. The altitude of the Dooars ranges from 90 to 1,750 m above sea level. Forests, tea gardens, rivers, and scenic beauty of the Dooars attract tourists. The Dooars region is crisscrossed by many rivers such as the Teesta, Jaldhaka, Murti, Torsa, Kaljani, Sankosh, Raidak, and Dyna. All rivers originate from the Himalayas. All the rivers of the Dooars region are part of the Brahmaputra drainage system. Many dams have been built upstream of some rivers to generate electricity and for irrigation purposes. It caused a reduction in water depth downstream and siltation.

A river is a natural flow of watercourse, generally fresh water that flows towards a sea, ocean, Lake or big river. A river's course can sometimes end on dry land without reaching another body of water. River generally receives water from precipitation, surface runoff, ground water discharge, springs, and glaciers. Many civilizations in the past were established on the riverside because, during that time, water transport was the only mode of transport. Even today, many industries are established on river banks because of the easy source of water. Two thousand nine hundred kilo meter is the total length of the Indian river systems, which support a huge amount of floral and faunal diversity. River runs long distance across the land area and provides freshwater for drinking, domestic, irrigation, and industrial activities (Sehgal, 1999). Rivers are very important due to their higher water-retention capacity and long-distributed water flow (Peel and Mcmahon, 2006). Rivers play an important role in the hydrological cycle. The interactions between elements such as water quality and quantity, physical structure, riparian zones, and floodplains, and the diversity of plants and animals living in rivers are driving forces which determine the structure and function of the river ecosystem (Rutherford *et al*., 2000).

Rivers are the best water purifiers in the world. Rivers have a huge capacity for depuration of polluted water caused by humans. Indian rivers harbour rich fish genetic resources (Vass *et al.*, 1997). Along its entire route, a river is a fundamental resource not only for human life but for fauna and flora too. Rivers are very crucial to maintaining the equilibrium of the environment and biodiversity. Disposal of domestic, municipal, and industrial sewage and agricultural

runoff directly into the rivers causes pollution of river water (Singh *et al.*, 2004 and Vega *et al.*, 1998). River water is very sensitive to minor changes in physico-chemical parameters.

The eastern part of the Himalaya has a greater diversity of coldwater fish in comparison to western Himalayan fishes (Sehgal, 1999). The rivers of the Dooars region are rich in coldwater fish, besides many tropical fish. Many game fish and ornamental fish are also found. The major stresses on the fish fauna are triggered by the deterioration of water quality, habitat degradation, over exploitation, irrational fishing, runoff fertilizer, pesticides from agricultural fields and tea gardens, and domestic waste. One of the great problems in North Bengal is the use of river beds as agricultural fields. The presence of exotic fish is another threat to fish diversity. Irrational fishing such as the use of mosquito nets for fishing causes the eradication of fingerlings. Indiscriminate and destructive fishing practices, such as the use of pesticides in river water, electro-fishing, and dynamite, reduce fish diversity (Dey *et al.*, 2015a). Construction of unplanned embankments in rivers causes loss of breeding grounds and habitat for fish (Goswami *et al.*, 2012). The rivers of the Dooars region are highly dangerous in nature for devastating flash floods which take away the fingerlings and adult fish. Freshwater fish species are highly sensitive to the alteration of aquatic habitats and are the most threatened taxonomic group (Darwall and Vie, 2005). Fish diversity has been regarded as a good indicator of aquatic ecosystem health (Bhat, 2003). Biodiversity plays a crucial role in the stabilization and protection of the ecosystem and environmental quality in the universe. Fishes are the major source of protein, mitigating the protein deficiency of developing countries like India. Ornamental fishes found in this zone are a great source of income for fishermen. The Terai and Dooars regions of North Bengal contribute about 70% of total exportable ornamental fish, indicating the huge potential of developing an ornamental fishery sector in this zone.

India is a mega biodiversity country rich in biodiversity and ranks ninth in terms of freshwater biodiversity and northeast region of India is recognized as a hotspot of freshwater fish species (Kottelat and Whitten, 1996, and Kansal and Arora, 2012). Barman (2007) recognized North Bengal as ‘Hot spot’ of freshwater fish due to the presence of many threatened and endemic fish species.

Phytoplankton is the primary producer of the riverine ecosystem and provides food and oxygen to other aquatic organisms in the aquatic food chain (Verma and Dattamunshi, 1987; Bohra and Kumar, 1999, and Sharma, 2004). The species assemblage of phytoplankton and zooplankton is

useful in assessing water quality (Ganon and Stemberger, 1978 and Rajagopal *et al.*, 2010). Many zooplankton and phytoplankton act as indicators of water pollution (Palmer, 1969). Zooplankton acts as an important source of food for fish.

Physico-chemical factors such as water temperature, pH, free carbon dioxide, and dissolved oxygen control the diversity and density of phytoplankton and zooplankton (Berzin and Pejler, 1987, 1989). Limnochemistry of water such as temperature, dissolved oxygen, pH and their fluctuation act as important determinants in riverine fish ecology (Boyd, 1982; Ali, 1999, and Thirumala *et al.*, 2011).

The important contributors to ichthyfaunal diversity in the Dooars region are Shaw and Shebbeare (1937), Hora and Gupta (1941), Jayram and Singh (1977), Paul *et al.* (2009), Sarkar and Pal (2008), Mondal and Kaviraj (2009), Acherjee and Barat (2011), Patra *et al.* (2011), Acherjee and Barat (2014), Bandyopadhya and Mondal (2014), Sarkar and Pal (2015), Das (2015), Dey *et al.* (2015a,b), Debnath (2015), and Saha *et al.* (2019).

Barat and Jha, 2002; Jha and Barat, 2003; Bhadra *et al*., 2003; Mondal, 2009; Mandal *et al*., 2011; Patra *et al*., 2011; Acherjee and Barat, 2011; Saha, 2014; and Pal *et al*., 2015; conducted research on the limnochemistry of river water in the Dooars region. Very little work has been done on the plankton diversity in the Dooars region (Mondal *et al.*, 2008, 2012a,b; Pal *et al.*, 2015 and Patra *et al.,* 2015).

Work on the limnochemistry, ichthyofaunal and plankton diversity of the rivers Teesta, Jaldhaka, and Torsa in the Dooars region is not adequate. Very little study has been done on endemism, species diversity, and richness of ichthyofauna of the Dooars region. So, research work on the limnochemistry, plankton and ichthyfaunal diversity of the rivers Teesta, Jaldhaka and Torsa in the Dooars region was undertaken.

2. OBJECTIVES

The main objectives of the present study are:

1. To study physico-chemical parameters of different rivers *viz*. Teesta, Jaldhaka and Torsa of the Dooars, West Bengal and their comparative analysis.

2. To determine the qualitative and quantitative diversity of plankton in different seasons.

3. To study ichthyofaunal diversity of different rivers in representing sampling sites of Teesta, Jaldhaka and Torsa of the Dooars, West Bengal.

4. To determine the present status/conservation status of fish species.

5. To study the causes of decline of ichthyofaunal diversity.