10. SUMMARY

Rivers have been studied for many years with input for many disciplines of science and humanities. The present study highlights the ecology and fishery potential of Pagladia river in Bagsa and Nalbari district during 2009-2010 in four different seasons. In this study several aspects of the ecological factors which affect the water system through direct or indirect ways, are analyzed and evaluated in various aspects.

The results which were observed during this study are summarized as below:

1. Sediment quality of Pagladia river was characterized by slightly acidic pH (6.45 ± 0.17 - 6.84 6.84 ± 0.08), lower values of organic carbon (0.02-0.78 %), available nitrogen (4.32 ± 0.87 - 246.55 ± 2.66 kg/ha), available phosphorus (0.04 ± 0.01 - 5.13 ± 0.07 mg/l), available potassium (34.55 ± 1.88-87.36 ± 2.25 mg/l), sandy loam to loam bottom.

2. The common features in respect of water quality of Pagladia river were slightly acidic (6.64 ± 0.32-6.97 ± 0.26), medium alkalinity (25.65± 0.38 - 69.62± 2.21 mg/l), soft to moderately hard water (31± 0.45 - 86± 1.34 mg/l.), rich DO (7.9± 0.29- 13.6± 0.41mg/l), poor values of FCO₂ (1.1± 0.01 - 6.1 ± 0.11 mg/l) and total chloride (3± 0.01- 34± 1.21 mg/l). Physico-chemical parameters are mostly found in the favourable ranges for the aquatic organisms.

3. Zooplankton density was poor in Pagladia river and ranged between 19 and 85 units/litre throughout the different seasons. During the present study 16 different genera of zooplankton consisting of 5 groups were recorded, of which 2 belonged to Protozoan, 6 to Rotifera, 4 to Cladocera, 1 to Ostracoda, 3 to
Copepoda. Rotifers were found to be dominant group (37 %) and Ostracoda as the group with least abundance (6 %) throughout the study period.

4. Phytoplankton density was poor in Pagladia river and ranged between 41 and 85 unit/litre throughout the different seasons. Similarly present study revealed the occurrence of 28 different genera of phytoplankton, of which 7 belonged to Cyanophyceae, 12 belonged to Chlorophyceae, 7 to Bacillariophyceae, 1 to Euglenophyceae, 1 to Dinophyceae. Chlophyceae were found to be dominant class (42 %) and Euglenophyceae along with Dinophyceae as the class with least abundance (4 %) throughout the study period.

5. Phytoplankton dominated over zooplankton. Winter was the peak season for growth of plankton followed by retreating monsoon and pre-monsoon while the minimum density was seen during monsoon.

6. During the present study 12 different genera of periphyton groups were recorded, of which 7 belonged to Chlorophyceae, 3 to Bacillariophyceae and 2 to Cyanophyceae. Chlorophyceae were found to be dominant group (58 %) and Cyanophyceae as the group with least abundance (17 %) throughout the study period.

7. During the study period 24 macroinvertebrate species belong to 6 groups and 19 genera have been recorded from Pagladia river, of which 24 species, 7 species belonged to Gastropoda followed by Crustacea (5 species), Hemiptera (5 species), Bivalvia (3 species), Diptera (2 species) and Odonata (2 species). Among all the groups of macro-invertebrate fauna Gastropoda were found to be the order with highest species composition (29 %) and Diptera along with Odonata with lowest species composition (8 %) respectively.
8. Among 24 macroinvertebrate species, 1 species assessed as dominant, subrecedent, 1 as subrecedent, 7 as recedent and 15 species as subdominant category.

9. During the present study 18 species of macrophyte under 17 genera were recorded, of which 6 species belonged to free floating macrophyte, followed by rooted submerged (3 species), rooted emergent with floating leaves (3 species) and rooted emergent or marginal (6 species). Station-5 was found to be richest in terms of macrophyte species richness (17 species) followed by station-3 (15 species), station-4 (150 species), station-2 (6 species) and station-1 (3 species).

10. During this investigation altogether 70 fish species belonging to 53 genera, 18 families and 7 orders have been recorded from the five stations of Pagladia river. The ichthyo species of the tributary belong to following orders- Osteoglossiformes, Cypriniformes, Siluriformes, Perciformes, Beloniformes, Synbranchiformes and Cyprinodontiformes. Out of these 70 species, 2 belong to family Notopteridae, followed by Cyprinidae (30), Nemacheilidae (3), Cobitidae (3), Bagridae (6), Siluridae (2), Schilbeidae (4), Pangasiidae (1) Sisoridae (2), Olyridae (1), Ambassidae (2), Anabantidae (1), Belontiidae (3), Channidae (4), Gobiidae (1), Belonidae (1), Mastacembelidae (3), Aplochelidae (1). Station-3 was found to be richest in terms of fish species richness (58 species) followed by station-3 (57 species), station-5 (50 species), station-2 (13 species) and station-1 (9 species).

11. Among the fish families Cyprinidae contributed highest species composition (30) and highest species richness of fishes was reported from station-4 (58). During the study period maximum species richness and species abundance was
reported during winter season and minimum species richness and abundance was recorded during monsoon season in all stations. Species diversity ($H'$) was reported maximum during winter and minimum during monsoon season in all stations.

12. Canonical Correspondence analysis (CCA) indicated the effect of physico-chemical parameters of water on fish abundance. Family Pangasiidae, Sisoridae and Gobiidae showed positive correlation with temperature. This clearly suggests that fishes of these families were abundantly recorded from sites with high temperature. Similarly family Notopteridae, Siluridae and Mastacembelidae showed positive correlation with TA and TC. It also indicated that physico-chemical parameters of water like total alkalinity and total chloride had influence on the distribution of fish families like Notopteridae, Siluridae and Mastacembelidae and species of such families were abundantly found from sites with high TA and TC. All the fish species of family Gobiidae, Schilbeidae, Olyridae, Cyprinidae showed positive correlation with water velocity, dissolved oxygen and TH. This clearly suggests that the fishes of such families prefer habitats with high dissolved oxygen content, water velocity and total hardness.

13. The CCA of fish abundance with zooplankton density as constrains revealed that Cladocera, Ostracoda and Rotifera are positively correlated with families like Cyprinidae, Schilbeidae, Sisoridae, Anabantidae, Osphronemidae, Mastacembelidae, Aplocheilidae, Nemacheilidae and Ambassidiidae. On the other hand, zooplankton group like Copepoda is positively correlated with families like Pangasiidae, Belonidae and Channidae. This suggests that the abundance of such families of fishes may be directly influenced by the density of Copepoda.
14. The CCA of fish abundance with phytoplankton density as constrains revealed that Chlorophyceae and Bacillariophyceae are positively correlated with families like Olyridae, Notopteridae, Belonidae and Mastacembelidae. On the other hand, phytoplankton group like Dinophyceae and Cyanophyceae are positively correlated with families like Cyprinidae, Cobitidae, Ambassidae, Bagridae, Schilbeidae, Nemacheiladae. Similarly, the phytoplankton group Euglenophyceae is positively correlated with families like Anabantidae, and Aplochelidae.

15. The CCA of fish abundance with periphyton density as constrains revealed that Cyanophyceae is positively correlated with families like Schilbeidae, Cobitidae, Bagridae, Ambassidae and Anabantidae. This suggests the growth of these families may have a direct correlation with density of Cyanophyceae Higher density of Cyanophyceae may favour the abundance of these fishes which may be due to its feeding habit. Similarly periphyton groups like Chlorophyceae and Bacillariophyceae are directly correlated with fish families like Gobiidae, Nemacheilidae, Olyridae and Mastacembelidae. This suggests that abundance of these families might have direct influence of the density of these two periphyton groups.

16. Many of the fish species reported from five stations of Pagladia river (87.14%) are considered as ornamental fish. Out of these 70 fish species recorded from Pagladia, 61 species were recognized as ornamental fish, of which 35 species identified as classified and 26 as non-classified ornamental fish.
17. Out of these 70 fish species recorded from Pagladia river, 61 species were assessed as least concern (LC), 6 near threatened (NT), 2 vulnerable (VU) and 1 data deficient (DD) as following IUCN (2012.2).

18. The main fishing seasons in Pagladia river was found to be winter, pre-monsoon and retreating monsoon. This study revealed that Cypriniformes (57.79 %) and Cyprinodontiformes (0.17 %) constituted about highest and lowest percent of the total annual fish catch. During fishing seasons, the catch is mainly dominated by fish species like Labeo rohita, Neolissocheilus hexagonolepis, Raimas bola, Catla, catla, Salmophasia bacaila, Cyprinon semiplotum, Amblypharygodon mola, Barilius barila, B. bendelisis, Puntius. sophore, Raimas bola, Sperata seenghala, Mystus cavasius, M. vittatus, Wallago attu and Mastacembelus armatus.

19. Different types of nets and fishing traps are used in Pagladia river for fishing. The common and effective fishing gears operated in Pagladia river are cast net (Asra jal), gill net, scoop net (Thela jal), drag net, chinese dip net (Parangi jal), Dip net/Lift net (Dheki jal), line fishing. Different fishing traps such as basket trap (Juluki and Polo) are also operated in shallow water zones of this tributary. Diversification of river channels is a common traditional methods practiced at this tributary.

20. Destructive fishing methods like use of pesticides and chemicals for fishing, blasting etc. are causing great threat to the fish diversity of Pagladia river. Anthropogenic activities like extraction of boulders from the upstream region are also altering the specialized habitat of hill stream fishes of Pagladia river.
21. From the present study it appears that the present condition of the tributary is suitable for fish growth and propagation. But due to the effects of some anthropogenic activities especially unscientific methods of fishing like blasting, use of chemicals or pesticides, diversification of channels hampers the high rate of fish growth and propagation in this ecosystem as these methods kills the mature, gravid as well as brood fishes. Moreover if necessary steps are taken for prevention of siltation this ecosystem would flourish with high fish species diversity and fishery resource.