CHAPTER 6: SUMMARY

Fishery resources of North East India are reducing in alarming rate. The challenge and need of the hour is to conserve fishes for sustainable uses which are becoming threatened due to habitat loss, anthropogenic activities and ornamental trade by wild caught practices in the Sonkosh river system of Assam. In the present study, effort has been made to investigate and record the ichthyo-faunal diversity and their conservation status in relation to physico-chemical characteristics of water and various fishing gears and crafts used by local communities. The details of this scientific work, regarded as first of its kind in this river system were embodied in this thesis incorporating six chapters. The summary of the findings are as follows:

The Sonkosh river system is very important for fresh water fish diversity in the region. The river system is blessed with assemblage of warm and cold water fish species distribution and some of them furnish a wide range of habitat (cold to warm and vice versa).

The survey also encounter eggs, juveniles and sub-adults caught through fishing nets suggests the river system is an ideal place for breeding of loaches, Garra spp., Snow trouts, Neolissochilus hexagonolepis, Labeo spp., Tor spp. and Danio spp. along with other highly priced fishes.

It was concluded that the seasonal and altitudinal variations affected the abundances and there by affect the catches of the fishes. The annual variations were slightly higher in the first year of the study periods in density-diversity indices of ichthyofauna.
Unique distribution of ichthyofauna like Pipe fish (*Microphis deocata*), belong to the family Syngnathide was recorded, since other species or genus of the same family is found in the Bay of Bengal, *i.e.* in a marine habitat. Two species of estuarine habitats; *Rhinomugil corsula* and *Pama pama* recorded shows its unique ichthyofaunal distribution among the rivers of Himalayan range.

Occurrence of 66 numbers of coldwater fishes indicates that the river is an important zone for distribution of cold water fishery resources. These cold water fishes are very sensitive to any changes in water temperature. With added stress of global warming, the impact on the freshwater aquatic animals, especially the cold water fish species could be devastating. The likely effect is shown for slower growth rate, low dissolved oxygen level, more susceptibility to pollutants, parasites and diseases. Among the cold water fishes 2% (EN), 10% (NT) and 1% (VU) threatened status according to IUCN was recorded.

The survey report comprises occurrence of 87 numbers of potential ornamental fishery resources suggest that the river system has potential for exploitation of ornamental fish collection and trades. Out of which, 28 numbers of species are wildly collected and supplied to various national and international agencies which are causing serious threats to the ornamental fish diversity. The IUCN threatened status of these fishes was assessed as 2% (EN), 8% (NT) and 1% (VU).

The 36 numbers of fish species showed restricted distribution patterns indicates the importance of the river system for conservation. Among the rare fish species higher percentage of threatened categories were recorded as 14% (EN), 59% (NT) and 4% (VU). Upstream sites and tributaries were the maximum priority sites for conservation with maximum numbers of rare and threatened species.
The mean values of water temperature (17.98°C), velocity (0.64 m/sec), depth (4.17 m), turbidity (22.73 NTU), pH (7.66), TDS (53.23 ppm), specific conductivity (104.35 μS cm⁻¹), dissolved oxygen (7.82 mg L⁻¹), free CO₂ (3.59 mg L⁻¹), alkalinity (mgL⁻¹), total hardness (mg L⁻¹) and chloride (10.99 mg L⁻¹) in Sonkosh river system were found within the limits of a healthy river system.

The present study showed that the density diversity indices of ichthyo-fauna varied seasonally in a predictable manner. But dominance and evenness index were not showed significant relation with seasonality. The variations of these indices may be regulated by other factors like selective fishing, environmental factor like rain fall and physicochemical characteristics of water. The fish species richness and diversity index was significant correlation with water temperature, velocity, turbidity and FCO₂. Abundance was significantly correlated with water depth and velocity. Dominance of species was significantly correlated with pH. CPUE was significantly correlated with water depth and velocity. The slight annual variations in CPUE, number of species, diversity index, dominance and evenness index indicated that variations might occur year after year in predictable manner.

The extraction by Principal Component Analysis (PCA) reduced all the physicochemical variables into two sets of uncorrelated transformed variables in the river system. Principal Component-I (factor-I) that is mostly the Chemical parameters and less physical parameters. Principal Component-II (factor-II) is loaded with more physical parameters and less chemical parameters. In the CCA analysis the most important physicochemical variables for the fish assemblages were found water depth, water velocity, alkalinity and pH as factor- 1 and water temperature, FCO₂ and DO as
factor-2. These variables showed significant association for the occurrence and abundances of the threatened and ornamental fish species in the present study.

The overall study reported that seasonality of this region affects the physico-chemical quality of the river system in different ways which as a far-reaching consequence alter the density and diversity of ichthyo-fauna in a predictable manner. Monsoon flood appeared to be acted as a driving force of diversification. The periodic cycle might be operating year after year in a predictable manner except in case of big natural calamity.

The study resulted in recording of Anguilla bengalensis, Tor putitora and Pillaia indica with endangered status and Labeo dyocheilus, Tor Putitora, Bagarius yarrelli, Ailia coila, Channa bleheri, Ctenops nobilis, Aborichthys elongatus were recorded with near threatened status. The river has large potential for capture fisheries particularly the ornamental and food fishes. Among the collected species Ctenops nobilis, Danio dangila, Oreichthys crenuchoides, Microphis deocata, Channa bleheri, C. andrao have very high commercial value as aquarium fish. To conserve such ichthyo-faunal diversity, a long term management and action plan should be adopted.

The illegal fish catching methods for food fishes like blasting, random fishing and electric fishing and habitat destruction like stone lifting are the major causes of depletion of ornamental as well as small indigenous fishes. Even after being in an unenviable position, the practice of unscientific wildly captured and export trading poses a sustainability threat to this region. So, for conservation of these living jewels of the lotic water system, a long term and effective management plan should be adopted to control the illegal fishing and export trades.
Two important indigenous technical knowledge used in preservation of fishing nets by the fruits of Gaub Tree (*Diospyros malabarica*) and the florets of Banana mixed spadix are unique to the present study site.

Two types of fishing crafts: the raft of angkhw (ikora grass, *Saccharum ravvenae*) and inflated rubber tube were unique and helpful to the poor fishermen in the river system.

The present study provides informative data and help to understand the present and future status of pristine health of the river system and very urgent need for its scientific record before and after the installation of Hydro-power Projects in the upstream of river Sonkosh.

Nevertheless, the wealth of fishery resources and habitat status still can be said in a sustainable condition and the river system is not polluted. It has an excellent fishery resource for indigenous varieties of both warm and cold water occurrence with potential ornamental, food and sport value. Though the river is affected by different anthropogenic hazards yet it has found rich diversity and abundance migrated from upstream. Because, it is to be mentioned here that in Bhutan, Bhutanese people follow Buddhism and so fishing and killing of fishes are banned by the Government. The rich fauna of the river system indicates that the river stretch is still in sustainable status and able to give a valuable endowment of fishery resources in the region.

But the assessment of fresh water fish diversity in down-stream of the Sonkosh river in India is not only timely but also necessary due to the rapid development sweeping over Bhutan Himalaya and the planned for mega-hydropower projects is expected to have a significant impact on the biodiversity of rivers of Bhutan as well as Indo Bhutan foot hill of Assam.
Recommendation For conservation Strategies

1. The portion of Sonkosh river stretch in the jurisdiction of Kachugaon forest
division should be declared as protected area.

2. Unregulated wild collection of ornamental fishes should be banned in the
Sonkosh river system.

3. Installation of Hydropower projects in the upstreams of Sonkosh river should
be reviewed.

4. Electro fishing techniques should be banned in the river system.

5. Proper management of endangered fish species identified in Sonkosh river
should be maintained by implementing state fishery rules.