CHAPTER-VII
CONCLUSION
Kashmir valley situated in the northern part of India within the Himalayan region is bestowed with a vast array of fresh water bodies. These water bodies exhibit a great diversity primarily owing to variations in their origin, altitudinal situation and the nature of biotic pressures. Among these water bodies the Anchar lake has been subjected to overexploitation for economic purposes. Household wastes, sewage and sewerage from the adjoining areas are drained into the lake indiscriminately. Further, agricultural run off from the surrounding fields, especially the fertilizers and the pesticide wastes from the floating gardens find their way into the lake. Above all the SKIMS hospital situated on the eastern side of the lake empties its effluents into the lake.

Due to these anthropogenic pressures and the negligence of the concerned authorities, the lake not only has become an eutrophic body but also has got diminished in its size. The problem has aggravated to the extend that the biotic fauna present within the lake and towards littorals have become victim of eutrophication. The fish fauna inhabiting the lake have declined to a great extent and the surviving ones harbour a number of ecto- and endoparasites. Subsequently, the parasitism has led to the haematological alterations of the host. The impact of eutrophication is not only restricted to the fish fauna but also to the organisms like amphibians
and water birds, inhabiting littorals of the lake, also suffer by helminth parasitic infestations.

Detailed limnological, parasitic and haematological studies in Anchar lake were conducted from March 2004 to February 2006. The various aspects studied during the investigated period are summarized as:

Physico-chemical analysis

The depth of the lake ranged from 0.60m to 1.75m. The heavy silt load through river Sind inlet, addition of the wastes and decomposition of macrophytes have raised the lake bed.

The water temperature of the lake varied at different sites with overall range between 4.0°C to 27.8°C. The water transparency of the lake ranged between 0.21m to 0.94m. The pH ranged between 6.8 and 8.8 showed alkaline trends in the lake. The conductivity values of the lake ranged between 280 $\mu$scm$^{-1}$ to 630 $\mu$scm$^{-1}$. The conductivity values were higher at the sites receiving agricultural run off, sewage and hospital wastes.

On the basis of calcium, magnesium and total alkalinity the water of the Anchar lake is of hard type. The calcium ranged between 25.0 to 60.0 mg/l, magnesium between 4.1 to 28.0 mg/l and total alkalinity between 118 to 395 mg/l. The concentration of all these have increased at sites receiving enough quantity of sewage, agricultural run off and hospital wastes.

The dissolved oxygen of the lake ranged between 0.3 to 9.5mg/l and the decline in concentration has occurred at sites where decomposition exceeds photosynthesis. The chloride ranged between 16 to 89 mg/l and the highest concentration of chloride was recorded at sites receiving sewage and hospital wastes in abundance. The overall sewage, agricultural run off and hospital effluents have lead to high total dissolved solid values in the lake more particularly at site V.
The ammonical-nitrogen ranged from 195 to 690 μg/l, nitrate-nitrogen- 170 to 570 μg/l, orthophosphate-phosphorus- 45.0 to 205 μg/l and total phosphate phosphorus- 215 to 630 μg/l. On the basis of their high concentration, the lake water is enriched and eutrophicated.

From the physico-chemical analysis of water, it can be inferred that the water of the Anchar lake showed an increase in calcium, magnesium, chloride, total alkalinity, ammonical nitrogen, nitrate-nitrogen and total phosphate phosphorus due to addition of agricultural runoff, sewage and hospital effluents. Due to high ionic concentration of these salts and presence of rich growth of macrophytes, water at Site II and V was less transparent, with low dissolved oxygen concentration and high total dissolved solid values. On the basis of increased concentration of nutrients, the Anchar lake can be put in the category of highly productive water body.

Thus, the accelerated rate of eutrophication in the Anchar lake has lead to the abundance of parasitism in the organisms living within and outside the lake. Fishes which serve as a protein rich diet and are consumed at a large scale were found to be heavily infected by a diverse and large number of parasites. Among the various helminth parasites, cestodes (Adenoscolex and Bothriocephalus), trematodes (Diplozoon and Clinostomum) and acanthocephalans (Pomphorhynchus and Neo-echinorhynchus) were frequently observed. Generally, the parasitism in the fish fauna was observed more during hotter months of the year depicting impact of pollution on the health of fish. Further, the intensity of infection of acanthocephalans was higher, followed by cestodes and trematodes.

The impact of pollution and parasitism subsequently lead to reduction in haemoglobin content and red blood cell number of the fish hosts, while as neutrophils and eosinophils were increased which is believed to be
associated with defense mechanism and immunological response of the host against the establishment of infections.

The prevalence of helminth infection found in amphibians (frogs and toads) during the present study included cestode (*Nematotaenia*), trematode (*Ganeo*) and nematodes (*Rhabdias* and *Cosmocerca*). The parasitic infestation was dominant during summer season. However, frogs were found to be more infected than the toads.

The infestation of parasites in birds (Duck & Goose) observed in the entire study included both ecto- and endoparasites. Among ectoparasites *Cuclotogaster, Goniodis* and *Liperus* were observed. The endoparasites collected from duck and goose during the entire study period included cestodes (*Raillietina* and *Choanotaenia*) trematodes (*Echinostomum* and *Notocotylus*), nematodes (*Ascaridia, Amidostomum* and *Heterakis*) and acanthocephalans (*Filicolis*).

The parasitic infestation showed a correlation with changing physico-chemical parameters especially temperature, dissolved oxygen, total dissolved solid, conductivity, ammonical nitrogen etc. and with the availability of the secondary host. However, the intensity of parasitic infection was found to be low in amphibians and birds in comparison to fish hosts because of their total dependence on aquatic medium.

From the present study, it can be concluded that the parasites are built in monitors of organisms and environmental stress and their response in terms of population shifts can be quantified and the numerical strength of parasites can be used as bio-indicators of fresh water ecosystems.