Chapter - V
Summary and Conclusion

The present probe is divided into four chapters. The first chapter deals with monthly water analysis of physico chemical parameters of three study stations selected viz. Kaleshwar (Vishnupuri/ Shankar sagar reservoir), Nagina Ghat and Shikar Ghat. Different physico chemical parameters studied were, Temperature (Air and Water), Transparency, Turbidity, Total Dissolved Solids (TDS), pH, Dissolved Oxygen, Free Carbon dioxide, Total Alkalinity, Hardness, Salinity, Chlorides, Available Phosphates, Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD).

The second Chapter is concerned with monthly variations of plankton density of three localities of the interest along with other invertebrate species reported.

Third chapter includes the diversity of fish fauna categorically analyzed for continuous study tenure from all three study stations of present investigation. The population density and abundance of fish fauna from three calculated and dominant fish species of three localities reported.

In present study air temperature was fluctuated from 18°C to 31°C at Station A, 20°C to 33°C at Station B and 22°C to 34°C at Station C, while water temperature was fluctuated from 22°C to 31.66°C at Station A, 23.66°C to 30.66°C at Station B and 25.16°C to 31.66°C at Station C.

Variations in transparency values were fluctuated from 21.96 cm to 93.12 cm at Station A, 6.10 to 39.62 cm at Station B and 18.61 to 60.13 cm at Station C.

Nil Turbidity was recorded at Station A, at Station B, Turbidity values were fluctuated from 0 ppm to 360 ppm and at Station C from 0 ppm to 130 ppm.
The Total Dissolved Solids were ranged from 161.33 ± 0.57 to 340.33 ± 0.57 ppm at Station A, 160.33 ± 0.57 to 560.33 ± 0.57 ppm at Station B and 169.66 ± 0.57 to 540.33 ± 0.57 ppm at Station C.

pH values of Station A fluctuated from 7.13 ± 0.05 to 8.66 ± 0.05, 7.33 ± 0.05 to 8.56 ± 0.05 at Station B and at Station C from 7.8 ± 0.05 to 8.73 ± 0.05.

Values of Dissolved Oxygen were ranged from 4.5 ± 0.05 to 13.2 ± 0.26 mg/lit at Station A, 1.53 ± 0.020 to 7.18 ± 0.05 mg/lit at Station B and 4.75 ± 0.06 to 14.58 ± 0.06 mg/lit at Station C.

The free Carbon dioxide values were fluctuated from 1.20 ± 0.01 to 54.07 ± 0.06 mg/lit at Station A, 6.51 ± 0.005 to 68.87 ± 0.06 mg/lit at Station B and 5.91 ± 0.005 to 59.95 ± 0.05 mg/lit at Station C.

Total Alkalinity was fluctuated from 53.5 ± 0.005 to 142.00 ± 0.005 mg/lit at Station A, 54.00 ± 0.005 to 230.00 ± 0.005 mg/lit at Station B and 60.00 ± 0.005 to 220.61 ± 0.015 mg/lit at Station C.

The Salinity at Station A, fluctuated from 0.1355 ± 0.01 to 0.9355 ± 0.01 ppt, at Station B, it was fluctuated from 0.1321 ± 0.005 to 0.8221 ± 0.02 ppt and at Station C, from 0.3388 ± 0.005 to 1.2088 ± 0.21 ppt.

The Chloride values were fluctuated from 12.53 ± 0.06 to 1075.04 ± 0.04 mg/lit at Station A, 142.03 ± 0.03 to 1146.03 ± 0.04 mg/lit at Station B and 106.53 ± 0.03 to 1190.03 ± 0.02 mg/lit at Station C.

Total Hardness was fluctuated from 4.82 ± 0.02 to 16.51 ± 0.02 mg/lit at Station A, 3.51 ± 0.02 to 40.43 ± 0.04 mg/lit at Station B and 4.01 ± 0.01 to 24.46 ± 0.01 mg/lit at Station C.

Monthly variations of Available Phosphate content at different study stations were from 0.0110 ± 0.001 to 7.45 ± 0.03 mg/lit at Station A, 0.0125 ± 0.0003 to 8.70 ± 0.17 mg/lit at Station B and 0.0105 ± 0.001 to 10.23 ± 0.04 mg/lit at Station C.
Biochemical Oxygen Demand values were fluctuated from 8.83 ± 0.03 to 122.03 ± 0.02 mg/lit at Station A, 6.82 ± 0.03 to 150.53 ± 0.03 mg/lit at Station B and 14.42 ± 0.03 to 100.44 ± 0.04 mg/lit at Station C.

Monthly Chemical Oxygen Demand values were fluctuated from 0.000267 ± 0.0001 to 0.0023 ± 0.005 mg/lit at Station A, 0.000667 ± 0.001 to 0.0052 ± 0.0002 mg/lit at Station B and 0.000467 ± 0.0001 to 0.002933 ± 0.0001 mg/lit at Station C.

Among biological characters of river Godavari phytoplankton communities recorded at various study stations belongs to various groups like Chlorophyceae, Bacillariophyceae, Cyanophyceae and the Euglenophyceae.

The Phytoplankton were scanty at Station A, the members of Chlorophyceae were dominant at Station B and the members of Bacillariophyceae were dominant at Station C. Among Chlorophyceae - Spirogyra, among Cyanophyceae – Anabaena, among Bacillariophyceae – Navicula and among Euglenophyceae – Euglena were the dominant species of phytoplankton at various study stations.

Among zooplanktons, Copepods were dominant at Station A and Rotifers at Station B and C. Among copepods – Cyclops, among Rotifers – Keratella and Brachionus were dominant at Station A, B and C respectively.

The total number of zooplankton at various study stations varied from 15 to 32 numbers per litre at Station A, 24 – 38 numbers per litre at Station B and 22 to 36 numbers per litre at Station C. Total of 13 zooplankton species belonging to 3 different groups were recorded from River Godavari.

The present investigation confirms the occurrence of 39 fish species belonging to six orders, 13 families and 20 genera from River Godavari. The order Cypriniformes was dominant with 16 fish species followed by order Perciformes (11) and Siluriformes with 6 fish species. Order
Clupeiformes, Channiformes and Mastacembeliformes were represented by each 2 fish species.

Fish species *Etroplus suratensis, Etroplus maculates, Tilapia mossambica, Tilapia nilotica and Osphronemus gourami* have been newly added to the fish fauna of River Godavari at study station C i.e. Shikar Ghat.

For present study common fishes from various study stations were selected for fecundity analysis. The fish species, *Mystus seenghala, Cirrhinus fulungee* and *Tilapia mossambica* were selected for fecundity analysis.

In *Mystus seenghala* the total number of ova varied from 880 to 1476, which gives an average of 40 to 44 numbers of ova per gram body weight.

The total number of ova in *Cirrhinus fulungee*, varied from 1132 to 3170, which has given an average of 39 to 48 numbers of ova per gram body weight.

The total number of ova in *Tilapia mossambica* varied from 846 to 4554, giving an average of 59 to 65 numbers of ova per gram body weight.

To conclude the present study, Gonadosomatic indices of *Mystus seenghala, Cirrhinus fulungee* and *Tilapia mossambica*, most abundantly available fishes from stations A, B and C were calculated.

The Gonadosomatic index of *Mystus seenghala* varied from 3.12 to 15.50, minimum in the month of December and maximum in the month of June.

The Gonadosomatic index of *Cirrhinus fulungee* varied from 4.13 to 13.37, minimum in the month of October and maximum in the month of June.

The Gonadosomatic index of *Tilapia mossambica* ranged from 5.68 to 32.06 minimum in the month of September and maximum in the month of December. It was also found that *Tilapia mossambica* twice in a year.
Present study dealt with the physico-chemical parameters of the river Godavari, along with some biological characteristics like plankton, invertebrates, aquatic plants and fishes.

Among the physico-chemical parameters, dissolved oxygen reached at the lethal limits at station ‘B’ i.e. Nagina Ghat, the reason behind is the direct dumping of sewage water in River at Station B. the waters at Station B showed heavy eutrophication. This can be easily noted on the basis of findings of present study. Likewise free carbon dioxide also crossed lethal limits at Station B. in all senses Station B was heavily polluted through the tenure of study period.

Station ‘A’ and Station ‘C’ did not show any large variations of the physico-chemical parameters. All parameters were in the range of permissible limits as suggested by some international agencies for drinking water and waters for the fishes.

Among the planktons some pollution indicators like Clostrium sp., Navicula Sp., Oscillatoria Sp., Euglena Sp., and Chlorella Sp. Were found abundantly at Station ‘B’. these plankton species are considered as the indicators of organic pollution. Presence of these species also confirm polluted nature of River at Station ‘B’ i.e. Nagina Ghat.

Fishes have shown very much diversity in their abundance and their occurrence in selected stretch of River Godavari. In upstream of the river i.e. at Station ‘A’ (Shankar Sagar Reservoir) there is a dense stock of commercially important fishes like Catla, Rohu, Mrigal along with some carnivorous fishes like Mystus sp., Channa sp. and Mastacembalus sp. No doubt reservoir water quality is good physico –chemically as well as biologically to maintain the stock of Indian Major Carps but there is population of carnivorous fishes too. The Indian Major Carps therefore should be protected from carnivorous fishes. One way of protection is to
lower down the production of carnivorous fishes. Therefore it is very necessary to survey the river for locating breeding grounds of the carnivorous fishes and disturbing their breeding migrations.

Physico chemical parameters did not support the growth of Indian Major Carps due to polluted nature of river at Station ‘B’. Carnivorous and weed fishes like *Chanda* sp., *Puntius* sp etc. were found abundant at Station ‘B’. These fishes can tolerate low oxygen content.

During present study, there was an occasion of heavy fish kill at station ‘B’; it was due to oxygen lack.

Station ‘C’ i.e. Shikar Ghat shown variety of fishes including major and minor carps. Some brackish water fishes like *Tilapia mossambica*, *Tilapia nylotica*, *Osphronemus gouramy* and *Etroplus suradensis* have been found at Station ‘C’, during present investigation.

Occurrence of these fish species along with their young ones shows that, these species breeds in river and they have established themselves in river. It is suggested to protect their breeding grounds, so that these fishes will be made available for consumers and the researchers as well.

Occurrence of *Tilapia mossambica*, *Tilapia nylotica*, *Osphronemus gouramy* and *Etroplus suradensis* at Station ‘C’ added new fish species to the fish fauna of river Godavari.

Present study will play a significant role in showing effect of physico-chemical and biological (Planktons) parameters on occurrence and abundance of the fish fauna of a particular area.

Some suggestions are recommended on the basis of present investigations are –

1) There should be awareness among peoples about education regarding the pollution due to their daily activities.
2) Ban the peoples like cloth washing, cattle washing, vehicle washing and swimming.
3) Ban the peoples to dump statues of Ganapati, Durga mata, during the occasions of Ganapati visarjan and Durga mata visarjan.
4) Ban the peoples to dump funeral wastes directly in the river water.
5) Municipal Council should take concrete steps regarding mechanical and chemical treatment of raw sewage, before dumping it directly into the river.
6) Migratory birds, which visit river Godavari every year should be protected by clean and calm environment.
7) A survey of breeding grounds should be made of river Godavari, for protection of fish stock.

Then and then only we can call River Godavari as a “H O L Y” river.

Conclusively it can be said that though waters of Station ‘A’ (Shankar reservoir) and Station ‘C’ (Shikar Ghat) are physico-chemically and biologically productive waters, waters of Station ‘B’ must be protected from dumping of raw sewage and other human activities, so that it will be possible to maintain a dense stock of commercially important fishes in entire stretch of river Godavari at Nanded city.