



**Conclusion**

## CHAPTER-6

### CONCLUSION

---

Benthic macro-invertebrates are ecologically important organisms in food webs and are integral in establishing trophic structure of an aquatic ecosystem. They also mix the sediments allowing exchange of oxygen, nutrients and pollutants between the water column and the bottom. Because of their inability to escape exposure to changing conditions (relative to more motile aquatic fauna), benthic macro-invertebrates are often used to assess the condition of an aquatic system since they integrate numerous environmental factors over time spans exceeding those of typical water quality monitoring.

During the present study water quality assessment of Kunda River from August 2010 to July 2012 using Benthic macro-invertebrates. The water samples were collected monthly from August 2010 to July 2012 and analyzed in the laboratory. Based on this experiment, it could be concluded that using the water quality to compare with the Water Quality Standard value. This work has permitted to study the diversity of benthic macro-invertebrates of a Kunda River (Distt. Khargone M.P.), characterised by 3 Phylum belonging to 5 classes for a total of 42411 organisms collected.

During the monitoring period August 2010 to July 2012, in each sampling sites Station-I, Station-II, Station-III and Station-IV was collected a total number of 42411 individuals. From these individuals 9970 are found

in the first monitoring station, 10427 in the second, 11710 in the third and 10304 in the fourth station.

A total of 42411 individuals were collected from the study area as shown in the table 21 to 60 of these Mollusca contributed the largest share constituting 48.74% of the total Benthic macro- invertebrate fauna, followed by Arthropoda (31.27%) and Annelida (19.99%) respectively.

The overall percentage composition of benthic macro-invertebrates of the river was highly dominated by pollution tolerant group Pelecypods, Gastropods, Insects and Oligocheates but less or absent percentage from pollution sensitive group of EPT (Ephemeroptera, Plecoptera and Trichoptera) indicating that the river was under long term environmental stress because macro-invertebrates provide more reliable assessment for long-term ecological changes in the quality of aquatic system as compared to rapidly

In the present study **Station-I** dominant species recorded were *Tubifex albicola*, *Thira tuberculata*, *Thiara scabra* *Chaoborus sp.* and *Chironomous sp.* and less dominant species *Thira lineata*, *Corbicula striatella*, *Lymnea auricularia* and *Lamelidens lamellatus* throughout the season. During the study period *Stylaria fossularis*, *Baetiella sp.*, and *Baetis sp.* were recorded in lower number. The aquatic molluscans are used as an important tool to study the water quality of rivers. The molluscans are helpful in purification of water in their capacity to act as scavengers.

In the present study **Station-II** during the study period the dominant species recorded were *Dero dorsalis*, *Lymnea auricularia*, *Lamelidens*

*corriccaunus*, *Pisidium clarkeanum*, *Lymnea acuminata*, and *Chaoborus sp.* while the species like *Dero cooperi*, *Daphnia cercinata*, *Cypris*, *Pila globosa*, *Thiara lineata*, *Thiara tuberculata* and *Chironomous sp.* was found less dominant throughout the season. In the present study the species like *Baetis sp.*, *Baetis simplex*, *Baetiella sp.*, *Ephemera sp.*, *Caehis sp.* and *Epeorus sp.* was recorded in minimum number and was found absent during July and August months. Show that the members of Gastopods and Pelecypods are dominated in this station. Thus S-II is less polluted compare to other stations. The peak of Molluscan density was observed in the month of January which may be due to soft and organically rich bottom, alkaline nature of water and higher concentrations of  $Ca^{2+}$  and  $HCO_3$ .

In the present study at **Station-III** the dominant species was *Tubifex tubifex*, *Telmatodrius multispinosus*, *Dero dorsalis*, *Stylaria fossularis*, *Tubifex albicola*, *Pila globosa*, *Thiara scabra*, *Digiostana pulchella*, *Lamellidens corriccaunus*, *Chironomous sp.*, *Chaoborus sp.* and the species *Limmodrilus hoffmeisteri*, *Branchiodrillus hortensis*, *Cypris* and *Cyclopes* was recorded less dominant throughout the season. In the present study the species like *Baetis sp.*, *Baetis simplex*, *Ephemera nadinac*, *Epeorus sp.* and *Heptagenia nubile* was recorded in minimum number the diversity was recorded maximum in summer season and minimum in monsoon season. Oligochaeta are usually favored by the organic environment and remain dominant in severally polluted conditions with special emphasis on *Tubifex sp.* which inhabit areas with strong sewage pollution and anoxic waters. During the present study species Arthropods taxa *Chironomous sp.*, *Chaoborus sp.* was numerically abundant. This genus is also used as a

pollution indicator since it is found abundant in the areas where organic and sewage pollution is very high.

In the present study at **Station-IV** the dominant species was *Tubifex tubifex*, *Limnodrilus hoffmeisteri*, *Dero dorsalis*, *Stylaria fossularis*, *Thiara scabra*, *Bellamyia bengalensis*, *Melanoides tuberculatus* and the species *Dero dorsalis*, *Stylaria fossularis*, *Tubifex albicola*, *Cypris*, *Digiostana pulchella*, *Lamellidens lamellatus* was recorded less dominant throughout the season. In the present study the species like *Baetis sp.*, *Baetis simplex*, *Ephemera sp.*, *Epeorus sp.* and *Heptagenia nubile* was recorded in minimum number throughout the season. In the present study at The Benthic macro-invertebrates diversity was maximum in April-May months and minimum in July-August months of study period. In the study during presence bioindicators, *Chironomus sp.* larvae and *Tubifex tubifex sp.* indicate the effect of pollution. *Chironomus sp.* larvae showed its peak during December and January which could be attributed to low water level in the river, less oxygen content along with sluggish movement of water during these months.

The river's environmental factors had directly and /or indirectly affected macro-invertebrates assemblages, showing that macro-invertebrates were useful indicators of water quality in Kunda River. A remarkable variety and abundance of macro-invertebrates were recorded from the Kunda River with the molluscans Gastropods and Pelecypods dominating, followed by the Phylum Arthropods insects was rich all sampling sites. So there were signs of deterioration of the river's water quality. The abundance of less-sensitive organism such as Caenidae and Heptagenidae, and the total

absence of the sensitive order Plecoptera and Tricoptera. However, there were few pollution-sensitive (i.e., Ephemerellidae, and Thiaridae), and some moderately-sensitive families (i.e. Baetidae).

It is concluded that during this study it is observed that an increase in the decaying matter during summer enhances the growth of Benthic macro-invertebrates. Also the pollution indicator species like *Chironomus sp.* and *Tubifex tubifex* showed water is polluted but not to much extent because of their low number in the study area.

The impacts of anthropogenic activities on the water quality, biodiversity and distribution of benthic macro-invertebrates were clear. Compared to the I, II and IV Stations, resistant benthic macro-invertebrates could be found at the III stations of the Kunda River with poor and low water quality indices. Therefore, the collection of certain benthic macro-invertebrates species particularly in polluted and non polluted parts of a river indicated that they could be used as potential bio indicators for river pollution. These benthic macro-invertebrates species can be used to establish biological criteria to classify the river ecosystem as being healthy or polluted.

Water quality depends on the local geology and ecosystem, as well as human uses such as sewage dispersion, industrial pollution, and use of water bodies as a heat sink, and overuse (which may lower the level of the water). Directly or indirectly all their effluents reach Kunda river causing severe pollution.

The assessment of water quality at Kunda river for a period of Two Year August 2010 to July 2012 via physicochemical analysis using Benthic macro-invertebrates indicated that the Kunda river water which were taken from the various sampling sites of Khargone district M.P. were analyzed and the analysis reports that the water quality parameters like Temperature, pH, Transparency and Alkalinity lie within the maximum permissible limit prescribed by EPA and WHO. But Dissolved Oxygen, Biological Oxygen Demand, Total hardness, Nitrate and Phosphate were found beyond the permissible limit of EPA and WHO standards. Similarly the presence of some benthic macro-invertebrates indicates the presence organic pollution in the river. There is therefore a need of for a regular monitoring of the water to reduce the pollution level and abundance of pollution tolerant benthic macro-invertebrate hence proper management of the Kunda River.

According to the Shannon–Wiener diversity index results it is conclude that the maximum impact of pollution in Kunda River is felt at S-III and since in between the S-II and S-IV enough geographical distance is not available for rivers self-purification and pollution abatement. Thus, stations III is the most affected area of this river. Humans may have the ability to manipulate the environment to suit their needs, but this requires a responsible approach. Our present generation must therefore stand up and be accountable for our actions, focusing our knowledge and intuition toward a better future that includes the availability of clean, freshwater for all the nations of the world.

The NSF-WQI used for rating of surface water quality in Kunda river of Khargone district indicates that the all four sampling sites with minor

differences are rated as medium. Good or excellent water quality of river is not found in the district. The index is simple and requires minimum water quality data for calculations. It can provide a convenient means of summarizing complex water quality data and facilitates communication to water quality managers and the general public. Regulating the total maximum daily load of water chemistry variables could help to increase the index values and thereby pristine water quality of the river.

### **RECOMMENDATIONS**

Loss of biodiversity worldwide has been well documented from decades, while the attention of the media and scientific community has been much focused on terrestrial ecosystems, other biomes such as freshwater rivers and streams have been attributed less consideration.

The river's water quality could continue to deteriorate if natural and anthropogenic sources of organic matter would continually be introduced. Thus, there should be constant monitoring of the river to be able to immediately identify the necessary mitigating measures that can be applied to prevent the further deterioration of the Kunda River. The disposal of domestic waste into the river results in to the change in physico-chemical parameters which have an adverse effect on the aquatic biodiversity. Some important suggestions/ recommendations are worthy of mention to minimize and control the pollution in river Kunda.

- The River provides a lot of benefits in the agriculture, recreation, industries and also it is habitat for large number of wildlife. Therefore, protection of river needs urgent intervention.

- It needs regular monitoring of river by using essential biological and physico-chemical parameters. The scientific information obtained from studies should be placed in systematic and accessible database in an appropriate institution to follow the trend.
- A continuous monitoring of the physico-chemical and biological parameters of the Kunda river is required which will be useful in the maintaining the productivity of the river and needs for in-situ conservation of aquatic biodiversity.
- The practice of direct mixing of domestic sewage into the river should be stopped. In our country more than 50% of water pollution is caused by domestic sewage. The domestic sewage should be treated first and then can be used in agriculture fields for irrigation purpose.
- Some factories discharge their effluents directly in to the river. It is well advised that industrial effluents should be treated first and then disposed off into the river. The factories should be established away from the water sources.
- The anthropogenic activities like bathing, washing, cattle bathing and sewage discharge on the bank of river should be banned/ minimized as possible.
- The awareness camps/ seminars should be organized in which local people get awareness about the importance of conserving water and aqua fauna.

- Further proper development of other parameters in biological monitoring systems must be stimulated.
- The frame work objective, functions, techniques - of a monitoring system on biological variables must be well observed to enable proper use and affect of these efforts.
- The use of biological variables in biomonitoring appears to be quite cost - effective, shows a wide range of response, and thus may be very useful.