CHAPTER - V
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COLLECTION OF FISHES FROM RIVER YAMUNA AT KALPI

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<th>Fish Name</th>
<th>Local name</th>
<th>Feeding Habit</th>
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<tr>
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<td>Patra</td>
<td>Carnivorous</td>
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<tr>
<td>Catla catla</td>
<td>Bhakur</td>
<td>Plankton feeder</td>
</tr>
<tr>
<td>Cirrhinus mrigala</td>
<td>Nain</td>
<td>Omnivorous</td>
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<tr>
<td>Labeo rohita</td>
<td>Rohu</td>
<td>Herbivorous</td>
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<tr>
<td>Wallago attu</td>
<td>Padhani</td>
<td>Carnivorous</td>
</tr>
<tr>
<td>Mystus seenghala</td>
<td>Tengar</td>
<td>Carnivorous</td>
</tr>
<tr>
<td>Rita rita</td>
<td>Rita</td>
<td>Carnivorous</td>
</tr>
<tr>
<td>Heteropeustes fossilis</td>
<td>Singhi</td>
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<td>Clarius batrachus</td>
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<td>Channa marulius</td>
<td>Saur</td>
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<td>Channa punctatus</td>
<td>Girai</td>
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<td>Mastocembelus armatus</td>
<td>Boam</td>
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<td>Labeo - Calbasu</td>
<td>Calbasu</td>
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</tbody>
</table>
Fig. No. 1  *Notopterus* - *notopterus*

Fig. No. 2  *Catla* - *catla*

Fig. No. 3  *Cirrhinus* - *mrigala*
Fig. No. 4  Labeo - rohita

Fig. No. 5  Wallago - Attu
Fig. No. 6  Mystus - seenghala

Fig. No. 7  Rita - rita

Fig. No. 8  Hetropneustes - fossilis
Fig. No.9  Clarius - batrachus

Fig. No.10  Channa marulius

Fig. No.11  Channa punctatus
Fig. No. 12  Mastocombelus armatus

Fig. No. 13  Labeo - calabasu
**General:** There are three approaches normally used for the analysis of any system, theoretical, experimental and semitheoretical. Theoretical approach is considered more appropriate as it provides inside information and allows both extrapolation as well as interpolation and also helps in optimization with full coverage of each parameter. Experimental data are taken to calculate the information desired. This may be considered as the second best as it may be determined independently. This method does not permit extrapolation and interpolation with high degree of reliability and accuracy. The third approach is based on combination of experimental investigation and theoretical development.

In the present investigation efforts have also been made to obtain accurate data on the effects of Temperature, pH, Dissolved Oxygen on *Heteropneustes fossilis*, *Clarius batrachus* and *Channa punctatus* obtained from river Yamuna, and finally the experimental results obtained have been explained.

The results and discussion in this Chapter have been presented in the following order.

1. Morphological changes
2. Tolerance limit
3. Physiological changes
1. **Morphological Changes**

1.1(a) *Effect of Temperature on Growth and Development of Heteropneustes fossilis.*

In control group, the weight and length increased by 0.04 percent and 0.03 percent respectively after 20 days. In high temperature treated fishes, the weight and length were decreased by 3.00 percent and 1.5 percent in 35 Degree centigrade after 20 days.

1.1(b) *Effect of Temperature on Growth and Development of Clarius batrachus.*

In control group, the weight and length increased by 0.05 percent and 0.04 percent respectively after 20 days. In high temperature treated fishes, the weight and length were decreased by 4.00 percent and 3.00 percent in 35 Degree centigrade after 20 days.

1.1(c) *Effect of Temperature on Growth and Development of Channa punctatus.*

In control group, the weight and length increased by 1.00 percent and 1.5 percent respectively after 20 days. In high temperature treated fishes, the weight and length were decreased by 4.00 percent and 5.0 percent in 35 Degree centigrade after 20 days.
1.2(a) Effect of pH on Growth and Development of Heteropneustes fossilis.

In control group the weight and length were increased by 0.25 percent and 0.9 percent respectively after 20 days. In high pH treated fishes, the weight and length were decreased by 3.5 percent and 2.5 percent in 9.5 pH after 20 days.

1.2(b) Effect of pH on Growth and Development of Clarius batrachus.

In control group the weight and length were increased by 0.3 percent and 1.0 percent respectively after 20 days. In high pH treated fishes, the weight and length were decreased by 3.5 percent and 3.0 percent in 9.5 pH after 20 days.

1.2(c) Effect of pH on Growth and Development of Channa punctatus.

In control group the weight and length were increased by 0.25 percent and 1.0 percent respectively after 20 days. In high pH treated fishes, the weight and length were decreased by 3.5 percent and 2.0 percent in 9.5 pH after 20 days.
1.3(a) **Effect of Dissolved Oxygen on Growth and Development of *Heteropneustes fossilis*.**

Growth and development were observed by means of weight and length. In control group, the weight and length were increased by 0.12 percent and 0.10 percent respectively after 20 days. In low D.O. treated fishes the weight and length were decreased by 9.5 percent and 7.0 percent in 3.0 to 4.0 ppm after 20 days.

1.3(b) **Effect of Dissolved Oxygen on Growth and Development of *Clarius batrachus*.**

Growth and development were observed by means of weight and length. In control group, the weight and length were increased by 0.15 percent and 0.10 percent respectively after 20 days. In low D.O. treated fishes the weight and length were decreased by 9.0 percent and 7.0 percent in 3.5 to 4.5 ppm after 20 days.

1.3(c) **Effect of Dissolved Oxygen on Growth and Development of *Channa punctatus*.**

Growth and development were observed by means of weight and length. In control group, the weight and length were increased by 0.10 percent and 0.12 percent respectively after 20 days. In low D.O. treated fishes the weight and length were decreased by 9.0 percent and 7.0 percent in 3.0 to 4.0 ppm after 20 days.
2. **Tolerance limit.**

2.1(a) **Effect of Temperature on Survival period for**

*Heteropneustes fossilis.*

All the fishes were alive upto 38 Degree centigrade of *Heteropneustes fossilis.* After 38 Degree centigrade they started dying at different time intervals. In 45 Degree centigrade all fishes died in 3-6 hours.

2.1(b) **Effect of Temperature on Survival period for**

*Clarius batrachus*

In case of *Clarius batrachus* all the fishes were alive upto 35 Degree centigrade. After 35 Degree centigrade they started dying at different time intervals. In 42 Degree centigrade all the fishes died in 3-6 hours.

2.1(c) **Effect of Temperature on Survival period for**

*Channa punctatus*

In case of *Channa punctatus* all the fishes were alive upto 35 Degree centigrade. After 35 Degree centigrade they started dying at different time intervals. In 45 Degree centigrade all fishes died in 3-6 hours.
2.2(a) Effect of pH on Survival period for Heteropneustes fossilis

All the fishes were alive upto 11.0 pH after 25 days in case of Heteropneustes fossilis. After 11.0 pH they started dying after different time intervals. In 13.0 pH all fishes died in 8-12 hours.

2.2(b) Effect of pH on Survival period for Clarius batrachus

All the fishes were alive upto 10.0 pH after 25 days in case of Clarius batrachus. After 10.0 pH they started dying after different time intervals. In 12.5 pH all fishes died in 8-12 hours.

2.2(c) Effect of pH on Survival Period for Channa punctatus.

All the fishes were alive upto 10.5 pH after 25 days in case of Channa punctatus. After 10.5 pH they started dying after different time intervals. In 13.0 pH all fishes died in 8-12 hours.
2.3(a) **Effect of Dissolved Oxygen on Survival Period for Heteropneustes fossilis.**

All the fishes were alive upto 3.5 to 4.0 ppm after 25 days in case of *Heteropneustes fossilis*. Below 3.0 ppm they started dying after different time intervals. In 1.5 ppm all fishes died in 4-8 hours.

2.3(b) **Effect of Dissolved Oxygen on Survival Period for Clarius batrachus**

All the fishes were alive upto 4.0 to 4.5 ppm in case of *Clarius batrachus*. Below 3.2 ppm they started dying after different time intervals. In 2.0 ppm, all fishes died in 4-8 hours.

2.3(c) **Effect of Dissolved Oxygen on Survival Period for Channa punctatus.**

All the fishes were alive upto 3.5 to 4.0 ppm, in case of *Channa punctatus*. Below 3.0 ppm they started dying after different time intervals. In 2.0 ppm, all fishes died 4-8 hours.
3. **Physiological Changes**

3.1 Change in Operculum Movement for Heteropneustes fossilis in Temperature.

The rate of operculum movement decreased with increasing Temperature. The fishes were found to survive for more than 25 days in these solutions. In control group of fishes, the breathing rate was normal. The rate of operculum movement reduced to 62 per minute when Temperature 35 degree Centigrade after 10 days as against 83 per minute in control experiments.

3.2 Change in Operculum Movement for Heteropneustes fossilis in pH.

It is seen that the rate of operculum movement decreased as the pH increased. The fishes were found to survive for more than 25 days in these solutions. In control group fishes, the breathing rate was normal. The rate of operculum movement was reduced to 60 per minute when pH was 10.0 after 10 days as against 76 per minute in control experiments.
3.3 Change in Operculum Movement for Heteropneustes fossilis in Dissolved Oxygen.

It is seen that the rate of operculum movement decreases as the Dissolved Oxygen decreases. The fishes were found to survive for more than 25 days in these solutions. In control group of fishes the breathing rate was normal. The rate of operculum movement was reduced in 55 per minute when concentration of Dissolved Oxygen was 3.0 to 4.0 ppm as against 70 per minute in control experiments after 10 days.

Conclusion:-

The present experimental investigation on Heteropneustes fossilis, Clarius batrachus, and Channa punctatus the impact of Temperature, pH and Dissolved Oxygen was interestingly similar. All the three fishes investigated are commonly found in river Yamuna, one of the most important rivers both for agriculture as well as industry in India.

In each case irrespective of Temperature, pH and Dissolved Oxygen taken for fish under investigations. It was observed that the high Temperature, pH and low dissolved Oxygen level of water, which cause scarcity of oxygen in water. It is expected that failure of respiratory organs led
to the suffocation in fishes and ultimately death.

This is also reflected by the fact that the size of the fish does not have any favourable effect on tolerance level of the Temperature, pH and Dissolved Oxygen. There are two possible explanations:

(i) Due to high temperature and low dissolved Oxygen scarcity of Oxygen is taking place in the water and death is caused due to suffocation.

(ii) A large amount of water contains high pH passes through the gills responsible for respiration and obviously the precipitation of organic matter in the gills.