

Temperature Stress on Opercular Beats and Respiratory Rate of Freshwater Fish *Channa Punctatus*

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Abstract- Now a Days increase atmospheric temperature is the matter of great discussing issues for the environmentalists to gain more relevant information on tolerance of the organism to the temperature. The sensitivity of fishes exposed to the pesticides as well as the changed biological factors. Temperature as an abiotic factor showed influence on the physiochemical parameter of all living organism. The present study was carried to evaluate the impact of different temperature range (35°C and 15°C) on the fresh water fish *Channa punctatus*. Alteration of the rising temperature observed on the opercular beats and respiratory rate showed increased trend, while the average opercular movements per minute at below room temperature showed decreased as compared to normal values. At 35°C temperature the respiratory rate were increased as compared to normal values, while at 15°C temperature treatment the respiratory rate of *Channa punctatus* was found to be decreased.

Index Terms- *Channa punctatus*, respiratory rate, opercular beats.

I. INTRODUCTION

Changes in the environment conditions is the major problem of this century, which changes the natural quality of water, various types of pollutions affects the environmental conditions and the environmental biodiversity. Due to the rising and decreasing in the environmental temperature it affects the animals living in the environment.

The rising of the seasonal temperature much more than previous era, the changes in the PH, temperature, stress of water becomes changes and increases which show the effects on the fishes and other water animals. Consequent to the general rise in air temperature, the river system have resulted in the disruption of existing socio-economic structures of population inhabiting their basin, **Benisten et al.,(1997); Beniston(2003)**. Due to ecological change and environmental imbalance, many plants and animal species have vanished, and many more are the edge of Extinction.

The life in aquatic ecosystem is directly or indirectly depends on water quality. The alteration of the physiochemical parameter of water affects the biota on its number and diversity. The inland fishery resources of India consisting of rivers, canals, estuaries, lagoons, reservoirs, lakes and ponds have a rich fish production potential; **Boyd (1982); Crasser and Edwards (1987); Das (2003); Saravanan et al.,(2003)**.

As the degree of toxicity of water increases it produce highly stress conditions on fishes, the degree of toxicity produced by the poisonous substance is dose dependent upon

environmental conditions such as temperature, PH of water, oxygen content and presence of residue molecules (**Capkin et al., 2006; Singh and Mishra 2009; Gulfer et. al., 2009**).

In the present investigation fish (*Channa punctatus*) were studied at different water temperature (35°C) and (15°C) changes in the opercular beat and respiratory rate become studied.

II. MATERIALS AND METHODS

The freshwater fish *Channa punctatus* which has been selected for study, commonly called as Snake headed; as due to their resemblance to head of a snake. All fishes used for study were of the size (40-150mm) and weight (0.90-60gm). The fishes of different size were sorted according to their size. When the fish were first brought into the laboratory were disinfected with 0.05% solution of KmnO₄ for two minutes and then transferred to a glass aquarium to acclimatized for 10 days. Water was changed and fecal matter removes daily. Fish were fed by prawn and artificial food twice or thrice a week.

Length weight relationship

For the present study different size of fishes were used. The fishes were cleaned and excess water was removed by blotting paper. After cleaning, the fishes were weighed up by a digital balance. The total length was measured from tip of the snout to the end of longer lobe of caudal fin.

The following general equation of length weight relationship as followed by Le cren (1951)
 $W = CL^n$ or $W = aL^b$ ($C = a$ and $n = b$)

Respiratory rate

The General study of respiratory rate also called as opercular beat frequency is studied with increase in fish length of freshwater fish *Channa punctatus*. The 40-160mm size of *Channa punctatus* selected for respiratory rate and there opercular beat which was counted per minute.

Groups I: As a control

Group II: As a group of fishes maintained for 15°C

Group III: As a group of fishes maintained for 35°C

III. OBSERVATION AND RESULT

Respiratory rate: In the present investigation, respiratory rate of freshwater fish *Channa punctatus* was studied with body length of fish and it also showed impact of physical stressor such as temperature variation at 35°C and at 15°C.

The mean respiratory rate of fish *Channa punctatus* with its body length observed to be 64.6±1.24, 58± 0.81; 57.6±1.46, 54.66±0.93, 47.33±0.96, 46±0.18, 42.3±0.46, 38.66±1.24, 37.33±1.69, 30.66±0.93, 27.33±0.45, 19.33±4.20 by fish length ranging 40-50, 50-60, 60-70, 70-80, 80-90, 90-100, 100-110, 110-120, 120-130, 130-140, 140-150, 150-160mm respectively, showed increased trend.(Table no.1)

Whereas when fish length relationship was observed with respiratory rate and its regression equation as

$$Y = -4.473 + 4.65 X$$

And coefficient correlation $r = 0.52$ showed moderate degree of correlation

Table.1 Effect of fish length on Respiratory rate of freshwater Fish *Channa punctatus*.

Sr. No.	Fish Length(mm)	Respiratory rate(Mean)
1	40-50	64.6±1.24
2	50-60	58±0.81
3	60-70	57.6±1.46
4	70-80	54.66±0.93
5	80-90	47.33±0.96
6	90-100	46±0.81
7	100-110	42.3±0.46
8	110-120	38.66±1.24
9	120-130	37.33±1.69
10	130-140	30.66±0.93
11	140-150	27.33±0.45
12	150-160	19.33±4.20

Fig.1 Effect of fish length on respiratory rate of freshwater fish *Channa punctatus* .

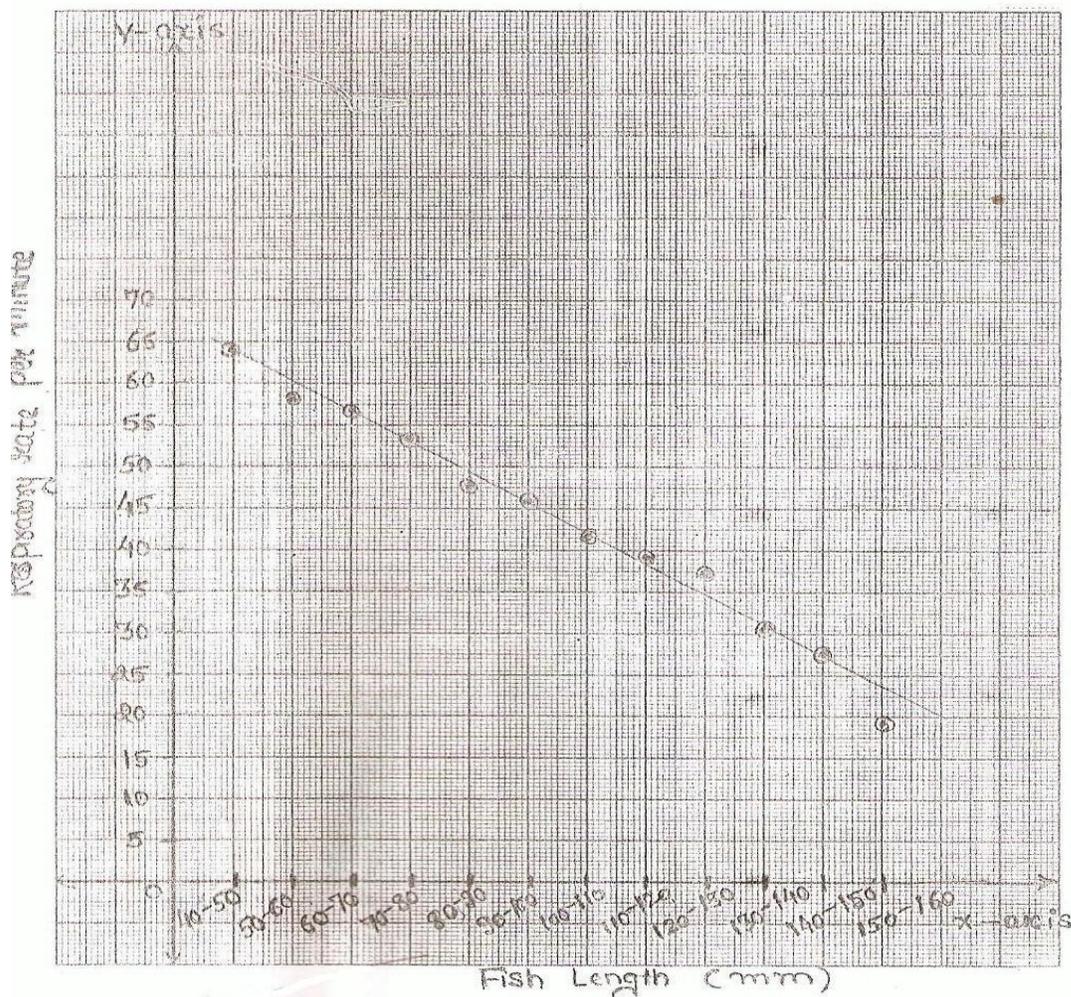
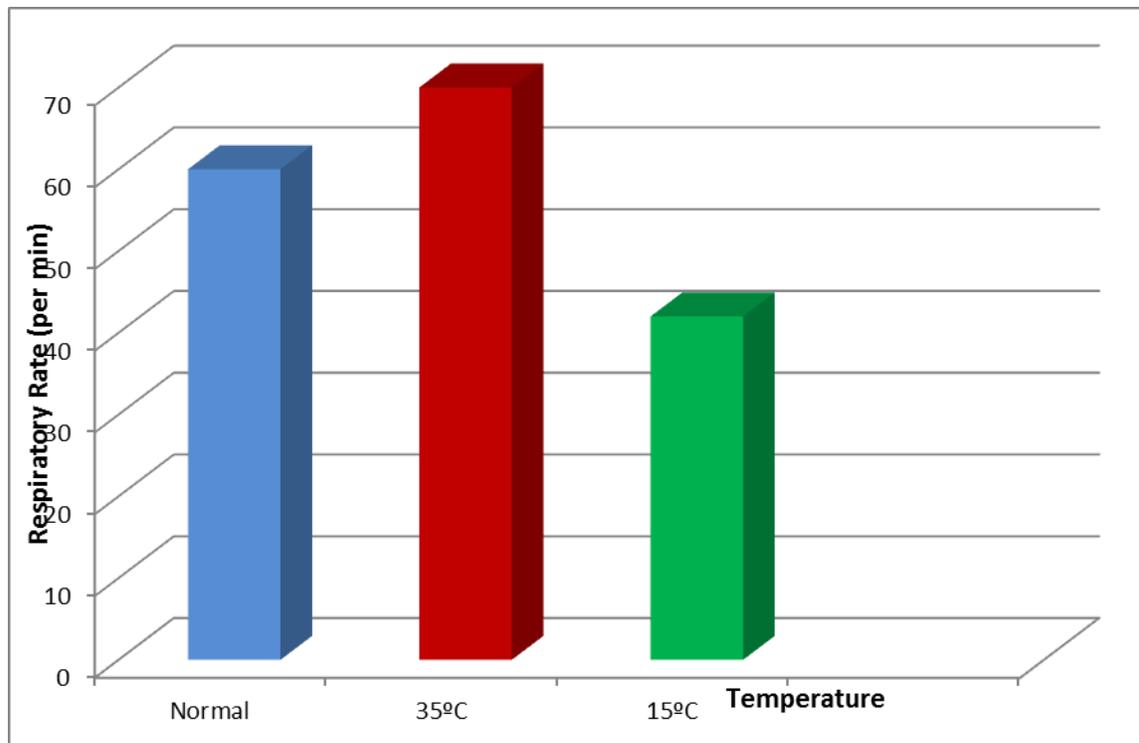


Table.2 Effect of different temperature ranges on the Operculum movement of freshwater fish *Channa punctatus*.

Sr. No.	Average fish length	Operculum movement per minute at normal temperature	Average operculum movement per minute at above room temperature (35°C)	Average operculum movement per minute at below room temperature (15°C)
1	30-130	58.25±2.87	70.75±2.98	56.5±3.00
2		43.5±14.46	62.75±3.44	40.0±0.51
3		34.75±2.06	43.1±0.57	26.5±2.41
4		64.75±1.25	78.75±0.95	27.5±6.28
5		58.75±7.97	71.1±2.87	57.75±6.44
6		34.75±0.55	59.25±0.58	30±3.86
7		73.0±0.81	74.25±3.09	61.0±3.91
8		57.5±3.89	58.1±2.70	23.5±3.10
9		62.5±2.05	72.75±3.75	40.75±10.81
10		40.5±0.80	56.5±4.50	40.0±11.38
Mean value		50.82	68.73*	40.35**

Values are significant at, P<0.01**, P<0.05*, N.S.-non significant.

Fig. 2 Effect of different temperature ranges on Operculum movement of freshwater fish *Channa punctatus*



Whereas when *Channa punctatus* fish exposed to temperature effect at 35° C and at 15°C it showed variations in respiratory rate. In 35°C temperature *Channa punctatus* fish opercular movement rate was 70.75, 62.75, 43.1, 78.75, 71.1 59.25, 74.25, 58.1, 72.75, 56.5 respectively and its mean found to be 68.73(table 2 and fig. 2)

But when fish *Channa punctatus* treated with 15°C temperature its opercular movement were 56.5, 40.0, 26.5, 27.5,

57.75, 30, 61.0, 23.5, 40.75, 40.0 and its mean value was seen to be 40.35(table 2 and fig. 2).

From the above temperature effect of 35°C respiratory rate of *Channa punctatus* was seen increased 68.73 as compared to control fish respiratory rate. While in 15°C treatment respiratory rate of *Channa punctatus* fish was found to be decreased 40.35 as compared to control (50.82)

IV. DISCUSSION

In the present study the impact of different temperature on the freshwater fish *Channa punctatus* showed increase trend in both respiratory rate and opercular beats at 35°C temperature. While at 15°C temperature showed decrease trend on respiratory rate and opercular beat of freshwater fish *Channa punctatus* as compared to normal temperature. Increase in temperature, rise in metabolic rate of fish and hence its oxygen demand, but it decrease oxygen solubility in water. This counter tendency may result in depletion of oxygen to lethal level.

The length of the fish increases during that period the opercular beats and respiratory rate were also increase. Opercular beat, respiratory rate depend upon size of fish and stress of temperature by **Gillooly et al., (2001)**. Also by **Tonck et al., (2000)** observed decreased temperature stressor on common carp.

Similar finding by **Curric et al., (1998)** observed rise in atmospheric temperature due to natural variation would directly influence the water temperature and ectothermic fishes. Also **Guderley et al., (1998)** showed that temperature and growth rate as modulator of the metabolic capacity of fish.

Also similar finding by **Wagner et al., (1997)** observed temperature stress response in Rainbow trout. The frequency of opercular beats was used as measure of respiratory rate by **Lolyd 1992**. Also **Dube and Munshi (1972)** observed certain studies were done on change in mode of respiration in relation to weight, length and temperature stress.

V. CONCLUSION

The study indicate that the increases and decreases in temperature of water impacts on the opercular rate of freshwater fish *Channa punctatus* which shows the increasing trend in respiratory rate with increase in temperature 35°C while decreasing trend in respiratory rate with decrease in temperature 15°C, which affects stress on the metabolic process of freshwater fishes. Thus there is need of maintaining temperature of water and environment temperature for preservation of local freshwater fish *Channa punctatus* for long time.

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