Effect of Water Temperature on The Growth Performance of Labeo Rohita

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Abstract - This study was conducted to investigate the effect of different water temperature on growth performance, of Labeo rohita. Water temperature is the most important factor for the fish growth and it affects all metabolic and physiological activities of fish and plankton. Water temperature plays an important role in influencing the periodicity, occurrence and abundance of phytoplankton as it had a direct relationship with total plankton (Mohapatra et al., 2002). Generally in low temperature, fish growth hampers due to less metabolic activities. Therefore, water temperature is a driving force in the fish life because its effects are more than any other single factor. Growth and livability in fish are optimum within a defined temperature range (Gadowaski and Caddell, 1991). During winter, temperature falls, thus influencing biological functions in fish. Labeo rohita is an important freshwater fish cultured in India, Therefore, growth rate of this fish and other cultured freshwater carps decreased during the low water temperature period. Therefore, to investigate the effect of different temperature ranges on the growth performance of Labeo rohita.

Keywords: Water temperature, growth, Labeo rohita, physiological, biological.

INTRODUCTION

Darbhanga, Bihar is rich in fresh water resources which can be utilized for fish culture. There is a considerable variation in environmental factors like temperature, precipitation, duration of photoperiod etc. which also physically affect the water bodies. Primary production of fresh water bodies is influenced by physical factors like temperature. For optimum fish production it is necessary to know about the variations in environmental factors under local conditions, which can be matched with managerial practices for maximizing fish production.

Water temperature is the most important factor for the fish growth and it affects all metabolic and physiological activities of fish and plankton. Water temperature plays an important role in influencing the periodicity, occurrence and abundance of phytoplankton as it had a direct relationship with total plankton (Mohapatra *et al*., 2002) Fishes are cold-blooded animals and dependent upon the water temperature in which they live. Generally in low temperature, fish growth hampers due to less metabolic activities. In winter season the growth rate of fish is slow. If we can maintain the water temperature in optimum level in winter season, then their growth rate may not be affected. Water temperature can be maintained at the optimal level favourable to fish growth through greenhouse system. In this phenomenon, solar radiation plays a major role to control the water temperature and greenhouse is a good alternative to maintain the water temperature. Greenhouse or plastic shelter ponds could achieve a 2.8-4.4 °C increase in water temperature compared to open-air pond. Fish is affected by the temperature of the surrounding water which influences the body temperature, growth rate, food consumption, and other body functions (Houlihan *et al*., 1993; Britz *et al*., 1997; Azevedo *et al*., 1998).

Therefore, water temperature is a driving force in the fish life because its effects are more than any other single factor. Growth and livability in fish are optimum within a defined temperature range (Gadowaski and Caddell, 1991). Although short-term changes, such as weather conditions, may influence a fish for a day or two, but temperature has more predictable and seasonal effect. Each fish species has an ideal temperature range within which it grows quickly. However, fish move into more favorable areas of a stream to regulate their body temperatures. In warmer environments fish have a longer growing season and faster growth rate but tend to have a shorter life span than in cool water. High water temperatures increase the metabolic rates, resulting in increased food demand. Although, fish can generally function in a wide range of temperatures, but they do have an optimum range, as well as lower and upper lethal temperatures, for various activities (Beschta *et al*., 1987) Freshwater fish have an optimum growing temperature in the range of 25-30oC at which they grow quickly. During winter, temperature falls, thus influencing biological functions in fish. *Labeo rohita* is an important freshwater fish cultured in India, Therefore, growth rate of this fish and other cultured freshwater carps decreased during the low water temperature period. Keeping in view the information given above, it can be envisaged that by understanding how temperature affects the performance of fish, particularly during winter season, a farmer can maximize his profit by exploiting maximum production potential of local fish species. However, information regarding the effect of water temperature on various species of fish in India is limited. Therefore, to investigate the effect of different temperature ranges on the growth performance of *Labeo rohita*.

Review of literature :

Review of related literature makes the investigator fully aware with the previous work that has been done. It also provides an opportunity of gaining insight into the method, measures, subject and approaches employed by the other researchers. A careful review of research, journals, books, dissertations, thesis and other sources of information about the problem to be investigated is one of the important steps in the planning of any research studied.

Mohapatra *et al*., (2002) Water temperature is the most important factor for the fish growth and it affects all metabolic and physiological activities of fish and plankton. Water temperature plays an important role in influencing the periodicity, occurrence and abundance of phytoplankton as it had a direct relationship with total plankton.
Chatterjee *et al*., (2004) Temperature beyond optimum limits of a particular species adversely affects the health of aquatic animal by increasing metabolic rates and subsequent oxygen demand.
Pang *et al.(*2010) A recent study found that environmental temperature had profound effects on the metabolic competition mode of southern catfish (*Silurusmeridionalis* Chen), possibly due to the increased oxygen demand and decreased availability of environmental dissolved oxygen at high temperatures.
Riddhi Sharma.et.al. (2008)'Study of Limnology and microbiology of Udaipur Lakes Limnological study summarized the water temperature varies with changing climatic conditions. They state that temperature is important controlling both quality and quantity of plankton flora. During this study Udaipur water observed water temperature to fluctuate between 21o C to 29 o C. In it increases microbes the higher values of microbial parameter gives clear ndication of very poor water quality has affect human kinds.
Pawar S.K. & Kanvate V.S. (2010) Hydrobiological study of three dams in Nanded district The present paper deals with the study of physio-chemical characteristic of comparative study of three dams in Nanded district, includes analysis of water quality for
number of parameter such as water temperature, water transparency, Total solids, total dissolved solids, total suspended solids, dissolved solids, total suspended solids, Dissolved oxygen, Hydrogen ion concentration, total hardness, Calcium, Magnesium, and
Total alkalinity etc. The significant range variation in various physico–chemical parameters of the dams were recorded which depicted the suitability of the dams for fish
culture.

MATERIALS AND METHODS :

Six weeks experiment was conducted in six glass aquaria in Laboratory, Department of Zoology, M.R.S.M. College, Anandpur, Darbhanga, Bihar. One hundred *Labeo rohita* finger-lings obtained from a local Fish Seed Hatchery were acclimatized on experimental diet for two weeks in the glass aquaria. After the acclimatization, 10 fingerlings were randomly stocked in each aquarium having water at three temperature ranges of 20-22, 22-24 and 24-26°C. Two replicates were followed for each water temperature range. The average initial body weight of the fingerlings was 8.65g. An experimental diet having 30% crude protein and 4.6 Kcal/g gross energy was prepared by mixing different feed ingredients. The feed was offered at the rate of 4% of wet body weight of the fish twice a day in feeding aquaria. After two hours of each feeding, the remaining feed was collected from each aquarium, dried and weighed to calculate net feed utilized by the fish. At the end of each experimental week, five fish from each treatment were taken out from each aquarium on replicate basis and weighed to record their weekly wet body weight. The total length was also measured. After weighing and body length measuring, these fish were released back into their respective aquarium. Mean wet body weight of the fingerlings in each aquarium was calculated to work out the feeding rate for the next week. The data on feed consumption and body weight gain were used to calculate feed conversion ratio according to Jhingran (1991). The data on body weight, total length and feed conversion ratio were statistically analyzed using completely randomized design under analysis of variance technique. The differences in the means were compared by Duncan's Multiple Range test according to the procedure described by Steel *et al*. (1996).

RESULTS :

Labeo rohita gained higher body weight 11.650 ± 0.212g under water temperature range of 24-26 °C. The next higher weight of fish was 10.803 ± 0.003g and 10.356 ± 0.062g in water temperature ranges of 22-24°C and 20-22 °C, respectively. The comparison of means of body weight in different water temperatures indicated that three water temperature ranges significantly affected the average body weight gain of the fish.
Labeo rohita attained higher total length (10.485 ± 0.191 cm) under temperature range of 24-26°C, followed by 22-24°C (9.720 ± 0.003 cm) and 20- 22°C (9.335 ± 0.078 cm,). The analysis of the data revealed that the temperature of water significantly influenced the total length of the fish. The interaction between weeks and water temperature in respect of total length gain was also significant. The comparison of means of total length
on different water temperatures indicated that all three temperature ranges differed significantly from one another. The fish kept in water having temperature between 24-26°C showed better FCR value (2.270 ±0.059), followed by 22-24°C (2.680 ± 0.146) and 20-22°C (2.970 ± 0.073). These results showed that temperature of the water significantly influenced the feed conversion values of the fish. However, the interaction between weeks and water temperature in respect of feed conversion ratio was non significant. Mean values of feed conversion ratio under three water temperature ranges were found to be significantly different from one another.

DISCUSSION

The results of the present study revealed that *Labeo rohita* fish maintained under low temperature (20-22°C) gained significantly less body weight as compared to the other treatment groups. The weight gain increased with increase in water temperature. These results support the earlier findings that growth and survival of fish are optimum within a defined temperature. The highest weight gain was observed in the fish maintained on 24-26 °C. Britz *et al.* (1997) observed that fish were markedly influenced by the temperature of water in which they lived. Increased growth has also been reported in *Labeo rohita* reared in polyhouse at average temperature of 19°C as compared with those in outdoor tanks at average temperature of 14.8°C. An increase in temperature increases the activity of digestive enzyme, which may accelerate the digestion of the nutrients, thus resulting in better growth. Hilge (1985) found that the optimum temperature for best growth

of European catfish *Silurus glanis* was within the range of 25 to 28°C with best results noted at 27°C. Brown *et al.* (1989) reported a 40% increase in growth rate of cod reared at 8.3°C compared with 4.5°C. This value was similar to that of Otterlei *et al.* (1994), who reported a growth rate increase of about 50% with each 4°C increase in temperature between 6 and 14°C. However, different fish require different temperature regimes; a range between 25-30°C being the optimum for *Labeo rohita*. The lower body weight gain of the *Labeo rohita* maintained in low water temperature (20-22°C) may be due to less feed intake than those kept under higher water temperature (24-26 °C) because Jauncey and Ross (1982) have reported that most species cease to feed at low temperatures (below 16°C). Therefore, better growth rate at 24-26°C in *Labeo rohita* may be attributed to the high water temperature, which increased the fed intake and metabolic rate of the fish.

The best FCR was observed in the fish kept at 24- 26°C temperature range, followed by those maintained at 22-24 and 20-22°C. These results are consistent with the findings of Andrews and Stickney (1972), who reported that channel catfish, *Ictalurus Punctatus*, fingerlings reared at a temperature range of 18-34°C registered improvement in FCR, with the best values obtained at 30°C. Osborne and Riddle (1999) observed better efficiency of feed in fish reared at high temperature than those kept at low temperature (17-27°C). However, the findings of Azevedo *et al.* (1998) revealed that water temperature had very little effect on feed efficiency of rainbow trout (*Oncorhynchus mykiss*). Probable explanation of improved feed efficiency of fish maintained at higher temperature might be the increased feed intake of the fish with increase in water temperature, which resulted in better growth of the fish, leading to better feed conversion ratio. Another probable explanation may be the less energy required for the process of thermoregulation to the fish kept at this temperature. Goolish and Adelman (1984) observed that an increase in temperature resulted in better utilization
of feed in fish than those kept under lower temperature (20.9-24.3°C). In contrast to the better efficiency of feed utilization at higher temperature range, Alanara (1994) did not observe any difference in the feed efficiency of rainbow trout reared at 5 or 15°C. This discrepancy may be due to difference in water temperature used in these studies. Better feed conversion ratio of the fish maintained at 24-26°C in this study may be attributed to the increased feed intake of the fish, which spared more nutrients for growth of the fish after meeting the maintenance requirements.

CONCLUSION

Water temperature ranging from 24-26°C seemed to be the most effective for rearing of *Labeo rohita*. However, the effect of water temperature on nutrient digestibility of the diet fed to the *Labeo rohita* still remains an important factor, which might play an important role in understanding the growth performance of the fish. The aquatic environment governs fish life; hence water quality should be suitable for fish. When environmental condition does not maintain in optimal range for normal fish growth, the fish culture could be affected. The major concerns of the fish culturist should be to deal with the aspects of water quality, which may cause poor growth or death of fish To a great extent water determines the success or failure of an aquaculture operation. Water quality is a dynamic web of the physical, biological and chemical factors, which constitute the water environment and influences the production of fish and other aquatic environment.

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