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Water quality assessment of two different sources in Parbhani

Rajesh Kumar Sahu, VV Deshmukh and N Krishnaiah

Abstract
The present study was undertaken to study the quality of Yelderi Dam water and retail fish shop water in Parbhani city. The pH, Hardness and total solids of Yelderi Dam reservoir water were 7.24, 148.33 ppm and 266. 66 mg/l respectively where as in retail fish shop water it was found 7.71, 625 ppm and 1233.33 mg/l. The total viable count of Yelderi Dam reservoir water and retail fish shop water were 5.88 Log CFU/ml and 6.44 Log CFU/ml respectively. Water quality of Yelderi dam reservoir was found to be of good quality in relation to physical and microbial characters than that of retail fish shop.

Keywords: yelderi dam, parbhani, water, quality

Introduction
Water approximately covering three-fourth of the earth's surface. Major sources of water available on earth is in saline nature; only a small quantity exists as fresh water. Fresh water has become a scarce commodity due to over exploitation and pollution (Patil and Tijare, 2001) [7].

Rapid industrialization, increased pollution, use of pesticides and fertilizers causing heavy and varied pollution to aquatic environment leading to deterioration of aquatic biota. The quality of water usually described according to its physical, chemical and bacteriological characteristics. Contaminated water can cause diarrohea, cholera, dysentery and various other diseases. The safety of water can be monitored in number of ways because the constituents of water can be measured directly (Sahu *et al*. 2015) [12].

Water quality determines to a great extent a success or failure of fish culture operation (Piper *et al.* 1982) [8]. Environmental conditions affect water quality which in-turn reflects in quality of fish production. Reservoir water is a fresh water how ever being influenced by factors like silt deposition, sewage and industrial pollution, physical characters of fish like pH, hardness, total solids gives an idea about its usefulness in fish culture(Torimiro *et al.* 2014) [17].

The microbial content of water is also of importance from public health point of view. Water is a major source of contamination of fish in relation to microbial hazard (Sabae *et al*. 2005) [10].

Parbhani is a district head quarter having a population around 3, 07,191 and a district head quarter. The district is having a reservoir at Yelderi on Purna River. The reservoir water of dam is used for carp culture of *Catla catla* on co-operative basis. The harvest is being sold in Parbhani retail market which is around 60 km from reservoir. Holistic evaluation of entire fish culture operation is important from public health point of view. Water quality of reservoir and at retail shop, physico-chemical and microbial assessment of fish at various stages of supply chain are important parameters to be studied from HACCP point of view (Sherikar *et al.* 2013) [13].

Keeping these facts on view present study was undertaken to study the quality of Yelderi dam water and retail fish shop water in Parbhani city from December 2014 to May 2015.

Materials and Methods
A quantity of 250 ml water samples were collected in sterile plastic bottles and transported on ice to the laboratory. A total of 50 samples each sources (Yelderi Dam and Retail fish shop) were collected from December 2014 to May 2015. Physical parameters of yelderi dam reservoir water and retail fish shop water were studied as per standard method by APHA (1998) [1]. The pH of water samples were recorded through pH meter model Systronic-361 calibrated with standard buffer solution. For total hardness calculation, 10 ml water sample was taken with addition of 2 drops of ammonium buffer and 2 drops of Eurochrome black

T solution in a conical flask. Then the sample was titrated with standard EDTA solution till colour becomes inkish blue.

$$\text{Total hardness in ppm} = \frac{(\text{ml of EDTA consumed} \times 1000)}{\text{ml. of sample taken}}$$

For total solids, a known volume of the well mixed water sample (50ml) was measured into a pre weighed crucible dish and evaporated to dryness at on a steam bath. The evaporated sample is dried in an oven for about an hour at 103^0 C-105^0 C and cooled in a desiccators and recorded for constant weight.

$$\text{Total solids (mg/L)} = \frac{(W1 - W2)\ (1000)}{\text{Sample volume (ml)}}$$

W1 = Weight of dried residue + crucible dish
W2 = Weight of empty crucible dish.

For evaluating total viable count (TVC), Standard Pour Plate Technique was followed. Dilution of inoculums was standardized for further use. A quantity of inoculums from 10^{-3} and 10^{-4} dilutions used for pour plate technique was 0.1 ml to which molten plate count agar (Hi-media Laboratories, Mumbai) (45-50^{o}C) was poured and mixed thoroughly by rotating plates. Incubation was done at 37^{o}C for 24 hours. TVC were calculated by using standard formula as per method described by AOAC (1997) [2].
The Bacterial colonies were counted with the help of the bacteriological colony counter and CFU was calculated by using the following formula

$$\log_{10} \text{CFU/ml} = \frac{\Sigma C}{[n_1 + (0.1 \times n_2)] \times d}$$

Where,
ΣC = Total number of colonies counted from all plates
n_1 = No. of plates of lower dilution
n_2 = No. of plates of higher dilution
d = Dilution factor

The data generated in the study was analyzed as per the method Snedecor and Cochran, 1967 [16].

Results and Discussion
Water quality is important from public health point of view as it is vehicle for biological and microbial hazardous substances. Source of water play an important role in determining its quality. It is impossible to prevent all pollution but minimum standards can be achieved by various means. WHO (1993) [19] recommended the guidelines for potable water based on acceptability aspects, microbial aspects, chemical aspects and radiological aspects (Park, 2005) [6].
Fish are in equilibrium with potential disease organism and their environment. Changes in this equilibrium, such as deterioration in water quality can result in fish becoming stressed and vulnerable to diseases. It is therefore important to know water quality parameters and their management that influence on growth and survival of fish (Ayyappan *et al.* 2013) [13]. In present study quality assessment of reservoir water and water used at retail shop was done in relation to physical and microbial characters.
pH is a measure of hydrogen ion concentration in water and indicate acidity and alkalinity. The pH in ponds rises during day time due to removal of CO_2 from water by phyto-planktons and other aquatic plants during photosynthesis. It decreases at night because of respiration and production of CO_2 by all organisms. Water pH affects metabolism and physiological processes of fish. The fish growth is best at pH 6-9. The water body should have alkalinity for fish growth (Ayyappan *et al.* 2013) [13].
In present study the mean pH values of reservoir water was recorded as 7.24 ± 0.02 and 7.71 ± 0.01 of water at retail shop. Comparison of mean pH values showed significant ($p<0.01$) differences among reservoir and retail shop water samples. The results are shown in Table-1. It is evident that the pH values at both sources of water were alkaline (pH >7). Earlier Sabae *et al.* (2005) [10] reported pH range of 7.28-8.91 of fish farm water in Egypt. The pH range of 6.8-7.3 was reported from water samples in Nigeria (Shittu *et al.* 2008) [14]. River water pH of 7.99 was recorded in Tamilnadu by Usharani *et al.* (2010) [18]. The pH of Almatti reservoir water found was between 7.04- 8.6 (Hulyal and Kaliwal, 2011) [5]. In present study pH of 7.24± 0.02 was observed in Yelderi dam reservoir indicating best for fish growth and ecological balance. However increased alkalinity (7.71 ± 0.01) observed in retail shop water may be due to underground water source.
Hardness is the concentration of metal ions like calcium and magnesium. Waters are classified based on hardness as soft and hard. The most productive waters for fish culture have a hardness and alkalinity of same magnitude. Water hardness affects fish health because it influences osmoregulation (Ayyappan *et al.* 2013) [13]. Hardness of water is disadvantages from public health point of view due to its effect on cleaning and sanitation, reduction in efficiency of metallic utensils, effect on cooking etc. (Park, 2005) [6].
In present study hardness of Yelderi dam reservoir and retail shop water was calculated and expressed in ppm. The means were compared between sources. The results are shown in Table-1. It is seen that the hardness of 148.33 ± 3.07 ppm was observed in reservoir water, which was 625 ± 13.35 ppm in retail shop water. The mean hardness values differ significantly ($p<0.01$) between sources. Yelderi dam reservoir water hardness of 148.33 ± 3.07 ppm observed can be classified as moderate hardness and that of retail shop water (625 ± 13.35 ppm) as severe hard (Ayyappan *et al.* 2013) [13]. Moderate hardness of Yelderi dam reservoir is helpful in maintaining osmoregulation of fish in reservoir. The severe hardness in retail shop water may pose public health hazards.
Total solids is a measure of all suspended colloidal and dissolved solid in water. This includes dissolved salts such as sodium chloride and solid particles such as sealed and plankton. Total solids in water come from runoff, industrial waste, effluents and carbon runoff. Aquatic organisms, plankton and decaying matters also contribute to total solids of water. Levels of total solids affect health of aquatic animals (EPA, 2012) [4].
In present study total solids of Yelderi dam reservoir water and retail shop water were estimated and their means were compared. The results are given in Table-1. The total solids of Yelderi dam reservoir water was found to be low (266.66 ± 42.16 mg/l) as compared to retail shop water (1233.33 ± 95.45). The results clearly indicate good water quality at Yelderi dam reservoir than that of retail shop.
Microbial quality of water indicates water pollution due to contamination. Bacteriological analysis of water samples is being done by calculating TVC of water samples. The method has been successfully used for evaluation of reservoir, pond,

and river waters (Rajanna *et al.* 2012; Saha *et al.* 2012) [9, 11]. Microbial quality of urban water sources is also being evaluated by calculating TVC (Shittu *et al.* 2008) [14].

In present study the TVC counts were successfully exploited to determine microbial quality of Yelderi dam reservoir water and retail shop water samples. The results are shown in Table-1. The mean TVC counts of 5.88 ± 0.03 Log CFU/ml were seen in reservoir water where as the mean TVC counts were 6.44 ± 0.01 Log CFU/ml of retail shop water. Comparison of mean TVC counts indicated significantly ($p<0.01$) higher levels in retail shop water samples than reservoir water. The reason for higher TVC values in retail shop water may be due to more sources of contaminations and poor sanitation at retail shop.

Conclusion

Water quality of Yelderi dam reservoir was found to be of good quality in relation to physical and microbial characters than that of retail fish shop. Major sources of microbial contamination in retail fish shops were there. In order to avoid the serious food borne illness in near future proper hygiene maintenance is required at retail fish markets.

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